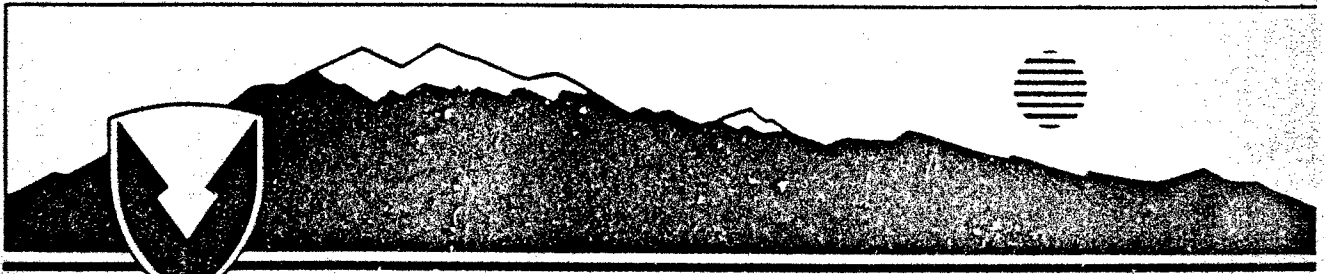


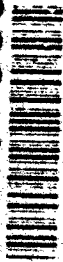
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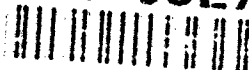
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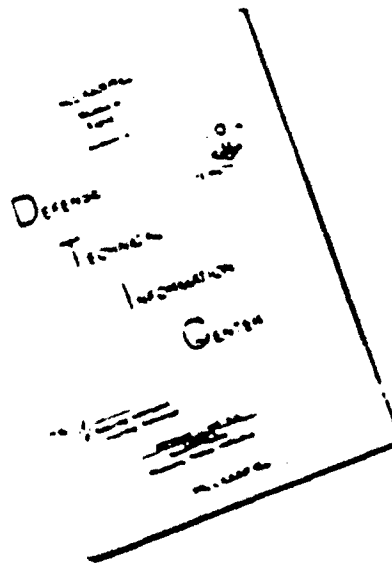
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LITIGATION TECHNICAL SUPPORT AND SERVICES

Rocky Mountain Arsenal

Offpost Operable Unit
Remedial Investigation and Chemical
Specific Applicable or Relevant and
Appropriate Requirements
Final Report
(Version 3.1)
Volume II

December 1988

Contract Number DAAK11-84-D-0016
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Prepared by

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
HARDING LAWSON AND ASSOCIATES

Prepared for

U.S. ARMY PROGRAM MANAGER'S OFFICE FOR
ROCKY MOUNTAIN ARSENAL

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APPENDIX A
WELL DESIGNATION CRITERIA

APPENDIX A
WELL DESIGNATION CRITERIA

WELL DESIGNATION CATEGORY	CRITERIA
1	Wells with screen bottom less than 3.0 ft below bedrock where bedrock is siltstone or shale.
2	Wells with screen bottom less than 3.0 ft below bedrock where bedrock is sandstone and less than 20 percent of screen length is below bedrock contact. or Well with screen bottom between 3.1 ft and 6.0 ft below bedrock contact where bedrock is sandstone and between 50 percent screened in bedrock.
3	Wells with screen bottom less than 3.0 ft below bedrock contact where bedrock is sandstone and between 20 and 50 percent of screen length is below bedrock contact. or Wells with screen bottom between 3.1 ft and 6.0 ft below bedrock contact where bedrock is siltstone or shale and more than 50 percent of the screen is below bedrock. or Wells with the screened more than 6.0 ft below the bedrock contact where bedrock is siltstone or shale.

WELL DESIGNATION CATEGORY

CRITERIA

4

Wells with screen bottom less than
3.0 ft below bedrock contact where
bedrock is sandstone and more than
50 percent of screen length is below
bedrock contact.

or

Wells with screens more than 3.0 ft
below the bedrock contact where
bedrock is sandstone

5

Well is screened entirely within
Denver Fm.

NOTE: If alluvium was consistently unsaturated at well site and well was
screened within Denver Fm, well was considered as a Denver Fm well and data
evaluated for inclusion into Denver Fm potentiometric maps and water
chemistry maps.

APPENDIX B
WELL COMPLETION SUMMARIES, LITHOLOGIC LOGS, AND GEOPHYSICAL LOGS

WELL CONSTRUCTION SUMMARY

Borehole E34D Well 34 37376
Project Name and Location T36 Well Installation, 9646 Ave Project Number 17053 07410
Drilling Company Boyles Driller 5 Roach Rig Number Failing 25
Drilling Method(s) continuous core

Borehole Diameter 7 7/8 in. 20 cm. 33 ft. 55 cm. to 55 ft. 33 cm.
12 1/4 in. 0 cm. 0 ft. 33 cm. to 33 ft. 0 cm.

Size(s) and types of Bit(s) 13/16" blade bit
7 7/8"

Sampling Method(s) Core

Size and Type PVC 4" schedule 40

Date/Time Start Drilling 2-18-87 1145

Total Borehole Depth 51 ft. 0 cm.

Date/Time Finish Drilling 2-19-87 1106

Depth to Bedrock 31 ft. 0 cm.

Date/Time Start Completion 2-19-87 1152

Depth to Water NA ft. 0 cm.

Date/Time Cement Protective Casing 2-19-87 1410

Water Level Determined By NA

Materials Used

Length Plain PVC (total) 42 ft. 0 cm.

Plain PVC 45.17' total (4x10" : 1x5")

Length of Screen 10.7 ft. 0 cm.

Slotted PVC 10.7' total (1x10")

Total Length of Well Casing 52.7 ft. 0 cm.

Bentonite Pellets 1 1/4 buckets

PVC Stick Up 1.7 ft. 0 cm.

Bentonite Granular

Depth to Bottom of Screen 51 ft. 0 cm.

Cement 85 bags

Depth to Top of Screen 40.3 ft. 0 cm.

Sand 3 bags

Depth to Top of Sand 39 ft. 0 cm.

Water added during completion -

Depth to Top of Bentonite 345 ft. 0 cm.

Water added during drilling -

Total Gallons of water added -

Drill Site Geologist C. Bensel

Date 2-20-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4-7-87/1500/K. Pacheco, M. Westcott

Date/Time/Personnel Casing Painted 4/14/87/1300/Ken Pacheco, Mark Westcott

Date/Time/Personnel Numbers Painted 4/15/87 JLF BAE 0947

Materials Used 13 bags quickcrete cement, 1/2 bag portland cement, 1/2 silicon for internal

Top of Protective Casing to Top of PVC 0.2 ft. 0 cm.

COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.22 ft. 0 cm.

Top of Protective Casing to Internal Mortar 1.23 ft. 0 cm.

Top of Protective Casing to Top of Cement Pad 1.52 ft. 0 cm.

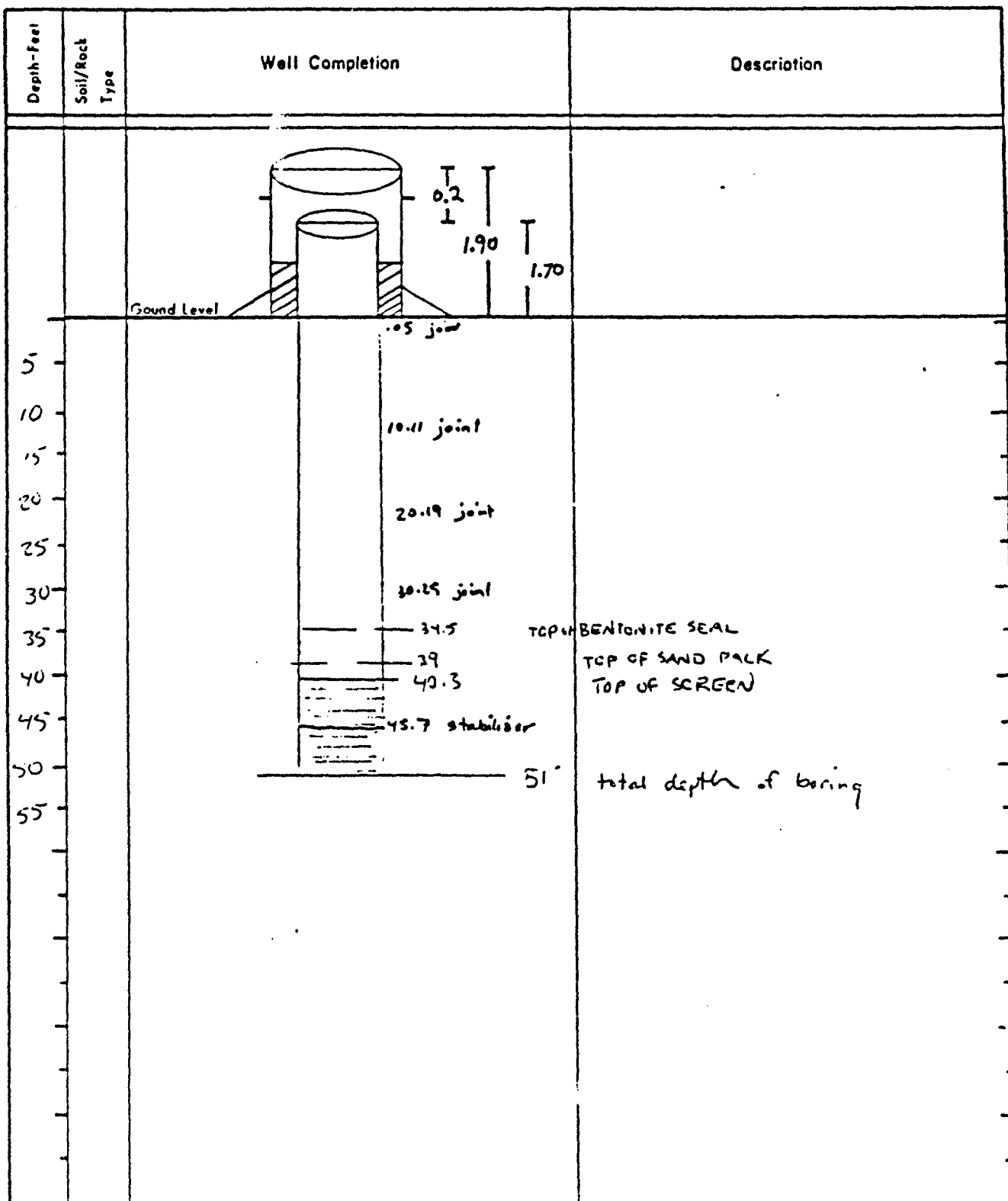
Top of Protective Casing to Ground Level 1.90 ft. 0 cm.

Reviewed By Joseph L. Reed Date 6/10/87

Drill Site Geologist Joseph L. Reed Date 6/10/87

Borehole: E34D

Well: 37376



Drill Site Geologist: C. Bensen
Reviewed By: Joseph R. Reed

Date: 2-20-87
Date: 6/10/87

BOREHOLE SUMMARY LOG

Borehole E-34 Well 37376
Project Name and Location MW Installation Project Number 17053 07410
Drilling Company Boyles Driller Roach Rig Number Failing 25
Drilling Method(s) Rotary - water used

Size(s) and type(s) of bit(s) 12 1/4" rock, 7 3/8" tricone
Borehole Diameter 12 1/4 in. 0 cm. 0 ft. 32 ft. 0 cm.
7 3/8 in. 0 cm. 82 ft. 35 ft. 0 cm.

Sampling Methods Continuous core

Total Number Soil Sampling Tubes NA

Total Number Core Boxes 0

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 2-17-87 0948

Date/Time Completed Drilling 2-17-87 1230

Total Borehole Depth 55 ft. 0 cm.

Depth to Bedrock 28 ft. 0 cm.

Depth to Water — ft. 0 cm.

Water Level Determined By? not determined - drilling with water

Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 2-18-87 0856

Depth of Tremmie Pipe 55'

Gallons of Grout 30

Materials Used 3 bags cement, 30 gal. water

Comments hole grouted to surface, casing breaking broken off
below surface

Wellsite Geologist C. Blum Date 3-23-87

Checked for Grout Settlement on 4/28/87 by JLR

Amount of Grout Added —

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 4/28/87

Drill Site Geologist — Date —

DEPTH Feet	Recon Inch	U	S	Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color		Lith. Char.	Lith. Class	Description/Comments
				Angle	Desc	S	H	1"	2"	Min	Major	M	G			
																CORING BEGINS AT 32'
																(Bedrock hit at 28'- cryptone)
32																
34	①		3/3		slightly finer											
36					1-2 fract.											
38			4/4													
40																
42			4.5/4.5		3-10 fract.											
44	②				2-4 fract.											
46			1/4.5		6-8 fract.											
48			1/1		2-4 fract.											
50																
52																
54																
56																
58																
60																
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88																
90																
92																
94																
96																
98																
100																

E.I. Inc. BORE E-340 WELL(S)

FSF, Inc. CORE LOG

By CDB

Date 2-25-87

BORE E-34

Well(s) _____

Page 2 of 7

DEPTH Feet	Roc. Int.	U S	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture/ Grain Size classified by mm	Lith. Char.	Lith. Class	Description/Comments
			Angle	Desc.		1°	2°	Min	Major					
					S	HL	HL	H		M	G			
52		3/4		very Friable						2.54	fine		CLs	
				↓						4/0				
										dark gray		S2 Shaly		
54		2/2		12/60 competat								S3		
												Lignite		
55										2.54		S%		
										40				
										black				
END OF BORING AT 55'														

WELL(S)

BORE E-34

E, Inc.



Frontier Logging

Lakewood, Colorado

ESE

E-34

RMA

ADAMS COUNTY

Township

Range

COLORADO

Elevation

Log Measured From

Ground Level

NATURAL GAMMA READING (ANALOG)
(Indicated by all scales)

EQUIPMENT DATA

T.D. Logged 55 1/2 Ft

Natural Gamma

200 Scale = 20

Time Constant

2 Sec 10

Count Source Surface

Probe No

103-1241

Probe Diameter

1 5/8"

Count Rate

2.35 x 10⁻⁵

Dead Time

7

Count Rate

1.10

Count Rate

3 7/8"

Resistance

40 ohms/5"

S.P.

20 MV/Inch

Date FEB. 18, 1987

Driller Depth 55 1/2 ft

Bit Size 3 7/8"

Casing Depth 32 ft

Fluid at Hole Water

Drilling Velocity

Operator Wm. Linton

Location Lakewood

Log Measured From

Ground Level

NATURAL GAMMA READING (ANALOG)
(Indicated by all scales)

EQUIPMENT DATA

T.D. Logged 55 1/2 Ft

Natural Gamma

200 Scale = 20

Time Constant

2 Sec 10

Count Source Surface

Probe No

103-1241

Probe Diameter

1 5/8"

Count Rate

2.35 x 10⁻⁵

Dead Time

7

Count Rate

1.10

Count Rate

3 7/8"

Resistance

40 ohms/5"

S.P.

20 MV/Inch

NATURAL GAMMA

20 cps

Initial Log

S.P.

20 MV

+

RESISTANCE

40

OHMS 5 inches

NATURAL GAMMA

20 40
COUNTS PER SECOND

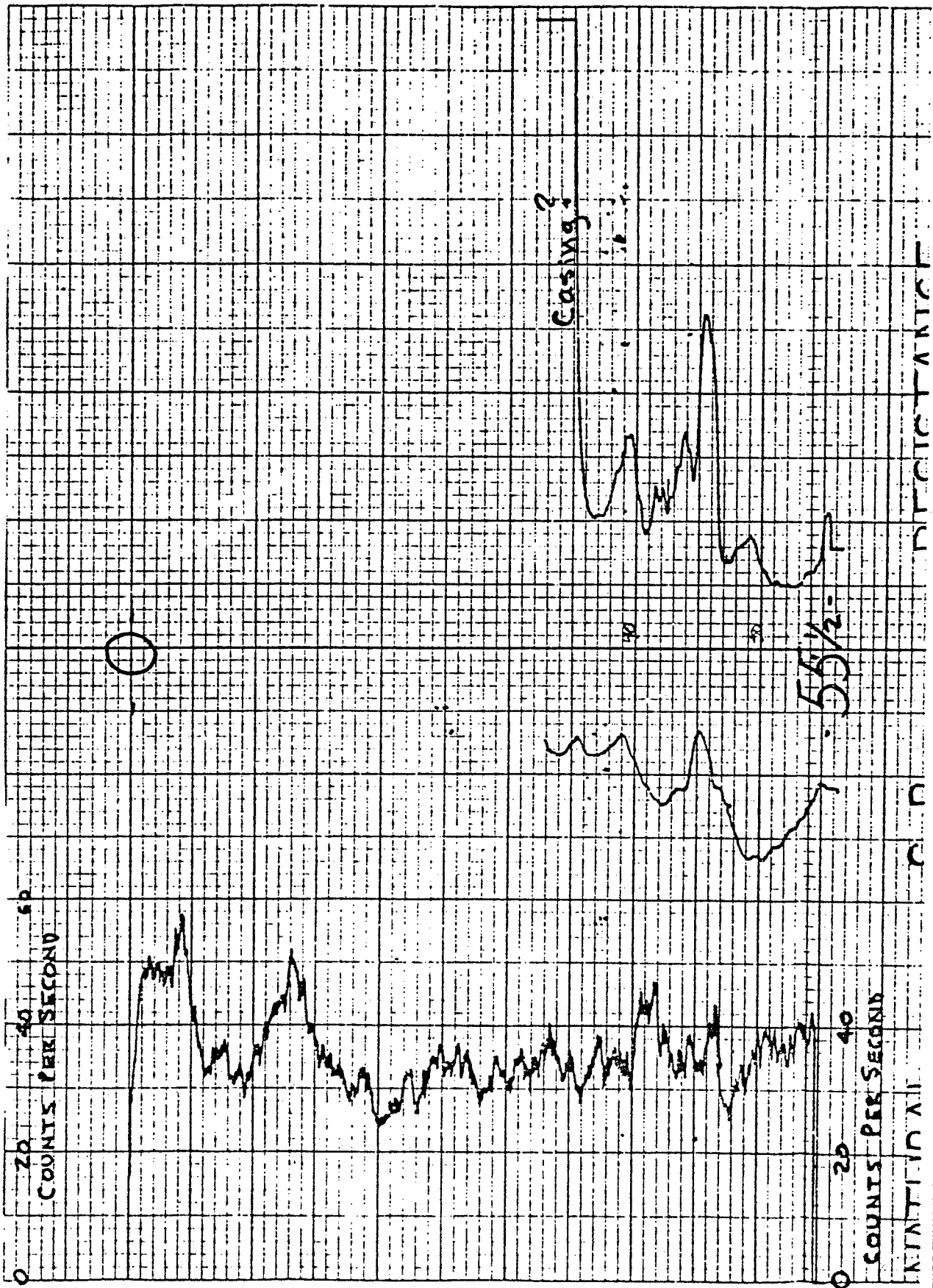
Initial Log

S.P.

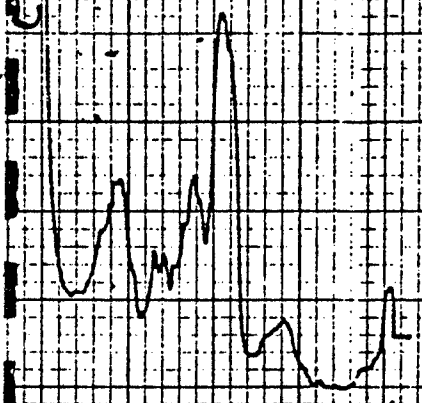
20 MV +
- 20 MV

RESISTANCE

40 OHMS/5 INCHES



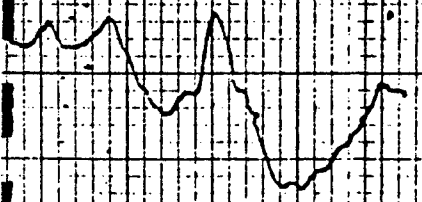
Casing



55 1/2"

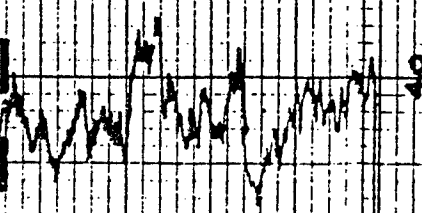
RESISTANCE

40 OHMS/5 INCHES



S.P.

20 MV/INCH



NATURAL
GAMMA

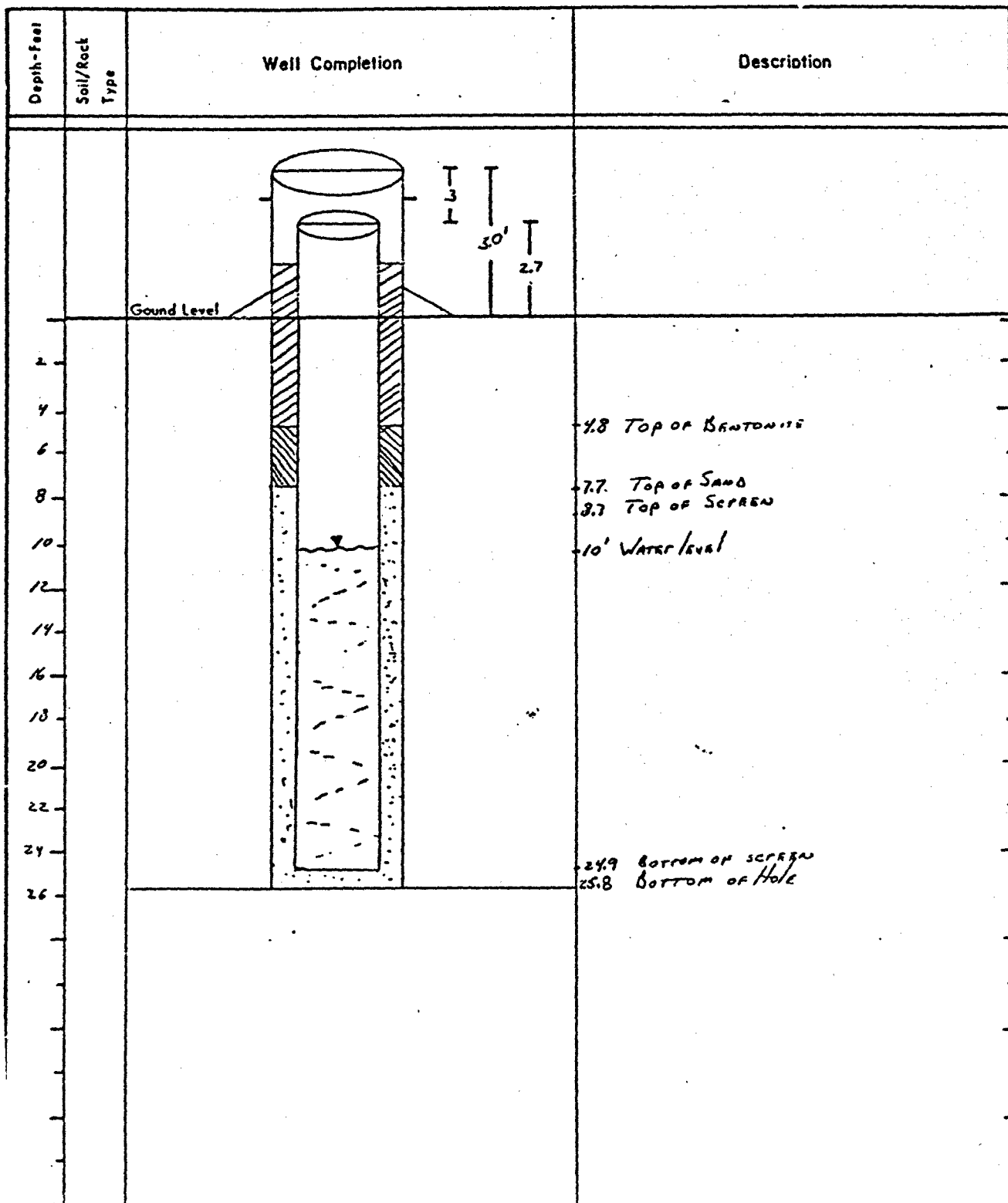
COUNTS PER SECOND

0 20 40

E-34

Borehole: E-38A

Well: JR E-38A 37374



Drill Site Geologist: Greg Litus
Reviewed By: Joseph H. Rios

Date: 3/2/87
Date: 8/20/87

WELL CONSTRUCTION SUMMARY

Borehole E-38A Well E-33A 37374
Project Name and Location Open-Drilling North NR 02 90th St. & Hwy 2 Project Number 17011-03910
Drilling Company Boyles Bros Driller Jarvis Rig Number _____
Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. _____ cm. 0 ft. _____ cm. to 2 1/2 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) _____

Size and Type PVC 4"

Total Borehole Depth 26.5' ft. _____ cm.

Depth to Bedrock 26' ft. _____ cm.

Depth to Water 10' ft. _____ cm.

Water Level Determined By Samples

Length Plain PVC (total) 14.5' ft. _____ cm.

Length of Screen 16.23' ft. _____ cm.

Total Length of Well Casing 27.6' ft. _____ cm.

PVC Stick Up 2.7' ft. _____ cm.

Depth to Bottom of Screen 24.9' ft. _____ cm.

Depth to Top of Screen 8.7' ft. _____ cm.

Depth to Top of Sand 7.8' ft. _____ cm.

Depth to Top of Bentonite 4.8' ft. _____ cm.

Sampling Method(s) Split-Spoon Continuous

Date/Time Start Drilling 1045

Date/Time Finish Drilling 1320

Date/Time Start Completion 1445

Date/Time Cement Protective Casing 1620

Materials Used 7-4' tubes 2 boxes

Plain PVC 1-10' 1-5' for 11.37'

Slotted PVC 1-10' 1-5' for 16.23'

Bentonite Pellets 3 1/2 Buckets

Bentonite Granular 0

Cement 2 bags

Sand 11 1/2 bags

Water added during completion 8 (3 Gals. 5 small buckets)

Water added during drilling 0

Total Gallons of water added 0 5 JK

Drill Site Geologist Bob Griggs, Greg Lous Date 3/2/01

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 04/08/87 1320 BJB

Date/Time/Personnel Casing Painted JWP BAB 4/15/87 0915

Date/Time/Personnel Numbers Painted JWP BAB 4/15/87 0915

Materials Used 14 BGS Quick-Crete 1/2 Bg Cement 1/2 Bg Sand 1 Roll Edging

Top of Protective Casing to Top of PVC 2.3' ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.5' ft. _____ cm.

Top of Protective Casing to Internal Mortar 2.3' ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 2.9' ft. _____ cm.

Top of Protective Casing to Ground Level 3.0' ft. _____ cm.

Reviewed By Joseph L. Reed Date 4/20/87

Drill Site Geologist Greg Lous Date 3/2/87

WELL CONSTRUCTION SUMMARY

Borehole E-38 D1 Well JR E-38 D1 37379
Project Name and Location MW Installation Project Number 1705307410
Drilling Company Boyles Driller Reach Rig Number _____
Drilling Method(s) continuous, rotary drilling

Borehole Diameter 2 1/4 in. _____ cm. 30 ft. _____ cm. to 30 ft. _____ cm.
4 3/8 in. _____ cm. 30 ft. _____ cm. to 56.5 ft. _____ cm.

Size(s) and types of Bit(s) 12 1/4" blade bit

Sampling Method(s) no sampling

Size and Type PVC 4" schedule 40

Date/Time Start Drilling 3-13-87 10837

Total Borehole Depth 56.5 ft. _____ cm.

Date/Time Finish Drilling 3-13-87 1056

Depth to Bedrock 27 ft. _____ cm.

Date/Time Start Completion 3-13-87 1100

Depth to Water unknown ft. _____ cm.

Date/Time Cement Protective Casing 3-13-87 140

Water Level Determined By _____

Materials Used _____

Length Plain PVC (total) 41.96 ft. _____ cm.

Plain PVC 1x5' 4x10'

Length of Screen 11.24 ft. _____ cm.

Slotted PVC 1x10' 1x5'

Total Length of Well Casing 53.94 ft. _____ cm.

Bentonite Pellets 1 1/2 buckets

PVC Stick Up 2.7 ft. _____ cm.

Bentonite Granular 1 bag

Depth to Bottom of Screen 55.5 ft. _____ cm.

Cement 7 bags

Depth to Top of Screen 39.24 ft. _____ cm.

Sand 2 1/2 bags

Depth to Top of Sand 37.8 ft. _____ cm.

Water added during completion 500 gal. cement

Depth to Top of Bentonite 33.4 ft. _____ cm.

Water added during drilling 450 gal

Total Gallons of water added 0940 gal.

This water was all pumped back out.

Drill Site Geologist C. Boyles

Date 3-16-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 04/08/87 11:00 PGR

Date/Time/Personnel Casing Painted J.F. BAE 4/15/87 0907

Date/Time/Personnel Numbers Painted J.F. BAE 4/15/87 0907

Materials Used 14 Bys Quick-Crete 1 Bg Cement 1 Bg Sand 1 Roll Paper

Top of Protective Casing to Top of PVC .1 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.40 ft. _____ cm.

Top of Protective Casing to Internal Mortar 1.43 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 1.74 ft. _____ cm.

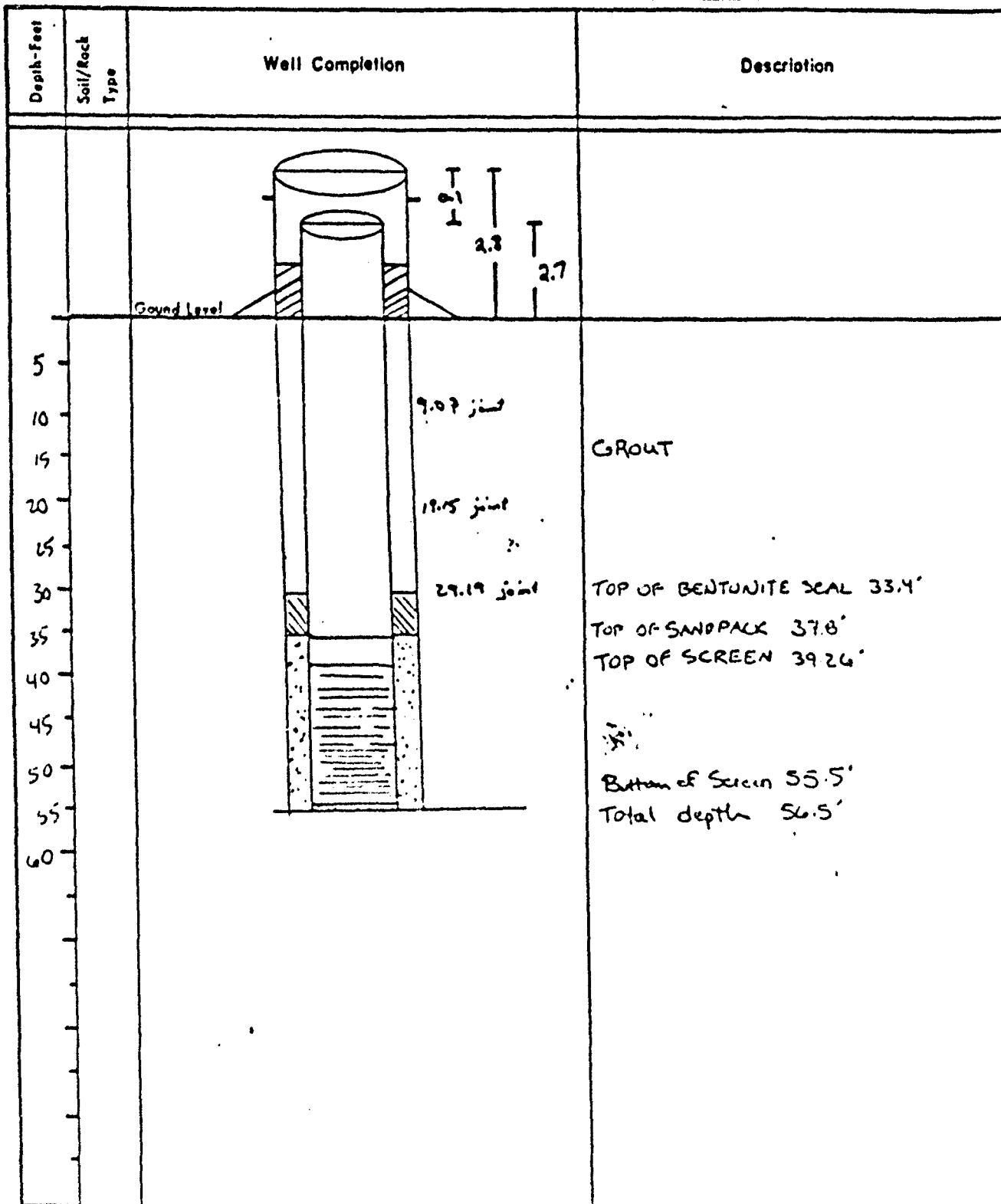
Top of Protective Casing to Ground Level 2.8 ft. _____ cm.

Reviewed By Joseph L. Ruel Date 4/20/87

Drill Site Geologist _____ Date _____

Borehole: E-37D1

Well: E-38 37379



Drill Site Geologist: C. Benson
Reviewed By: Joseph Lind

Date: 3-11-87
Date: 4/20/87

WELL CONSTRUCTION SUMMARY

Borehole E-3802 Well 37380
 Project Name and Location Hwy. 2 MW Installation Project Number 1705307410
 Drilling Company Bayles Driller B. Roach Rig Number Fielding 25
 Drilling Method(s) Rotary - drilled with water

Borehole Diameter 17 1/2 in. _____ cm. 0 ft. _____ cm. to 30 ft. _____ cm.
11 3/4 in. _____ cm. 30 ft. _____ cm. to 55 ft. _____ cm.
47/10 " 55 ft. to 75 ft.

Size(s) and types of Bit(s) 17 1/2" tri-cone,
11 3/4" blade bit, 9 5/8" blade

Size and Type PVC 4" schedule 40

Total Borehole Depth 75 ft. _____ cm.

Depth to Bedrock 27 ft. _____ cm.

Depth to Water NA ft. _____ cm.

Water Level Determined By NA

Length Plain PVC (total) 66.2 ft. _____ cm.

Length of Screen 10.71 ft. _____ cm.

Total Length of Well Casing 76.7 ft. _____ cm.

PVC Stick Up 8.7 ft. _____ cm.

Depth to Bottom of Screen 75 ft. _____ cm.

Depth to Top of Screen 64.29 ft. _____ cm.

Depth to Top of Sand 59 ft. _____ cm.

Depth to Top of Bentonite 54 ft. _____ cm.

Sampling Method(s) NA

Date/Time Start Drilling 3.23.87 1006

Date/Time Finish Drilling 3.23.87 1115

Date/Time Start Completion 3.23.87 1130

Date/Time Cement Protective Casing 3.23.87 1540

Materials Used _____

Plain PVC 7 x 10"

Slotted PVC 1 x 10"

Bentonite Pellets 1 bucket

Bentonite Granular 43 bag

Cement 8 bags

Sand 4 bags

Water added during completion 5 cod

Water added during drilling 1200

Total Gallons of water added 1700 0

Water pumped back out into 28 barrels

Drill Site Geologist C. Benson

Date 3.23.87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 9/2/87 unf. R. Pacheco M. Westcott

Date/Time/Personnel Casing Painted 4/8/87 1900 R. Pacheco M. Westcott

Date/Time/Personnel Numbers Painted 4/15/87 0925 F. F. B. A. G.

Materials Used 8 bags quickcrete, 1/2 bag portland cement, 1 1/2 bag silica sand

Top of Protective Casing to Top of PVC 0.2 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.1 ft. _____ cm.

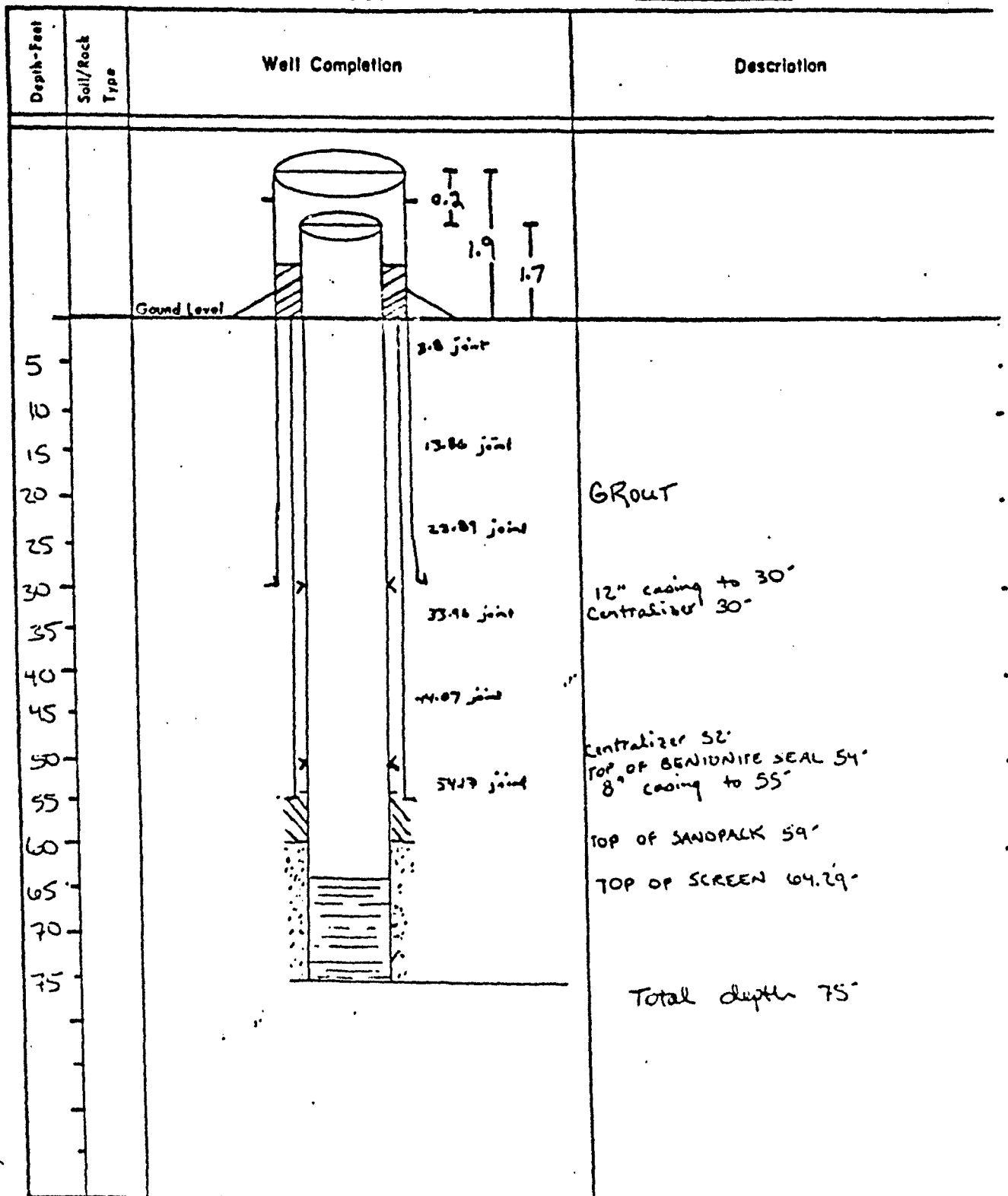
Top of Protective Casing to Internal Mortar 1.67 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 1.4 ft. _____ cm.

Top of Protective Casing to Ground Level 1.9 ft. _____ cm.

Reviewed By Joseph Reed Date 4/20/87

Drill Site Geologist _____ Date _____

Borehole: E38D2Well: 37380Drill Site Geologist: [Signature]Reviewed By: [Signature]Date: 3/23/87Date: 3/20/87

Borehole: E-38A

Well Number: 37374

SOILS LOG						Description
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
0.0						MUNSELL COLORS
0.0 - 1.0	0-1'	1'	NA	0-1'	ML	<p><u>ML</u> Sandy-silt, 10% v.f.g. sand, 10YR, 3/2-3 v. dk. graysh. brn., non-plas., loose, moist, alluvium</p> <p>At 1.6', color changes to 10YR, 5/2-3, graysh brn., moisture decreases to slightly moist.</p> <p>At 2.0' color changes to 10YR, 5/4-6, graysh brn., percentage of v.f.g. sand increases to ~25%.</p> <p>At 5.0', percent v.f.g. sand increases to ~40-45%, color changes to 10YR, 5/3, brn., moisture increases to moist.</p>
1.0 - 1.6	1-2'	1'		1-2'		
1.6 - 2.0	2-3'	1'		2-3'		
2.0 - 3.0	3-4'	1'		3-4'		
3.0 - 4.0	4-6'	2'		4-6'		
4.0 - 5.0	6-8'	1.25'		6-8'	SM	<p><u>SM</u> silty-sand, 25% silt, 10YR, 5/3, brn., non-plas., loose, wet, alluvium.</p> <p>Moisture change to saturated, H.T. @ 10.0'</p>
5.0 - 6.0	8-10'	1.5'		8-10'		
6.0 - 7.0	10-12'	1'		10-12'		

Drill Site Geologist: A.E. Odell

Date: 3/3/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

Borehole: E-38A

Well Number: 37374

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						Munsell Colors
11.0	10-12'	1'	NA	10-12'	SM	At 12.0, percent silt increases to ~40%.
13.0	12-14'	2'		12-14'		
14.0	14-16'	2'		14-16'	ML	ML = sandy silt, 10-15% f.g. sand, 10 YR, 6/3-4, pale br., non-pls, med. dense, wet, alluvium
16.0	16-18'	1.75'		16-18'	SM	SM = ^{silty} fine sand, 15-20% f.g. sand to 20% silt, 10 YR, 5/4-6, yellow br., non-pls, loose, wet, alluvium
18.0	18-20'	2'		18-20'		
20.0	20-22.5'	2'		20-22.5'		
21.5	21.5-23'	1.75'		21.5-23'		

Drill Site Geologist: S.E. Dettl
Reviewed By: Joseph L. Reid

Date: 3/3/87
Date: 4/16/87

Borehole: E-38A

Well Number: 37374

SOILS LOG					
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
22.0	21.5 - 23'	1.75'	NA	21.5 - 23'	PM
23.0	23 - 25'	2'		23 - 25'	
24.0	25 - 26.5'	1.5'		25 - 26.5'	
25.0					
26.0					
26.5					
27.0					
28.0					
29.0					
30.0					
31.0					
32.0					
33.0					
34.0					
35.0					
36.0					
37.0					
38.0					
39.0					
40.0					
41.0					
42.0					
43.0					
44.0					
45.0					
46.0					
47.0					
48.0					
49.0					
50.0					
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90.0					
91.0					
92.0					
93.0					
94.0					
95.0					
96.0					
97.0					
98.0					
99.0					
100.0					

CL = silty-clay, 30% silt, 10% 6/6-8 ben-yellow, slightly
 plus, soft, moist, below.

END OF BORING LOG

Drill Site Geologist: A.E. Smith
 Reviewed By: Joseph L. Reed

Date: 3/3/87
 Date: 3RD 4/16/87

BOREHOLE SUMMARY LOG

Borehole E-38 Well NA
Project Name and Location MW Installation Project Number 17053 074 40
Drilling Company Boyle Driller Jarvis Rig Number Fairing 25 Aug
Drilling Method(s) auger to 30', rotary to 130' Fairing 25

Size(s) and type(s) of bit(s) 17 1/4, 7 7/8 rock bit
Borehole Diameter 17 1/4 in. cm. 0 ft. cm. to 30 ft. cm.
7 7/8 in. cm. 30 ft. cm. to 130 ft. cm.

Sampling Methods Continuous core

Total Number Soil Sampling Tubes —

Total Number Core Boxes 14

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 3-6-87 0738

Date/Time Completed Drilling 3-10-87 1418

Total Borehole Depth 130 ft. cm.

Depth to Bedrock 25.8 ft. cm.

Depth to Water ~ 10 ft. cm.

Water Level Determined By? DR760A water level indicator

Borehole Completed as Monitoring Well? no

Date/Time Grouting Completed 3-10-87 1700

Depth of Tremmie Pipe 130'

Gallons of Grout 90

Materials Used 9 bags cement, 1 bag bentonite, 90 gals. water

Comments grouted to surface

Well Site Geologist C Benson Date 3-23-87

Checked for Grout Settlement on _____ by _____

Amount of Grout Added _____

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 4/13/87

Drill Site Geologist _____ Date _____

MAX DEPTH	Roc Int	U	S	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture/ Grain Size	Lith. Char.	Lith. Class	Description/Comments
				Anale	Dase		1"	2"	Min	Max					
						S	M	H	H	H	(M)	G	DI	LO	100
30															Cement - alluvium logged on soils log
32															
34															
36															
38															
40															
42															
44															
46															

CEMENT

Cement - alluvium
logged on soils log

massive
fract.
2-4/A.

54

cks

cleopstone

5/6

lim: hem concentrated
as fracture coatings

lim:
hem
cat
free olive

mass.
41%

54

occs.
carbon-
aceous
(0.1%)
potted

Silt to 15%

4/2

dark
gray

ds/
st

54

6/6

olive
yellow

43" 1/2" rounded pebbles
of calcite/dolomite visible
in core

rock type change is
transitional

WELL(S)

BORE E-38

SE, Inc.

BOX No.	DEPTH Feet	U	S	Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color	Grain Size class of gr mm	Lith. Char	Lith. Class	Description/Comments
				Angle	Desc	S	M	1"	2"	Min	Max					
												(M)	UI TO 100			Fe CM (Scale 1" = <u>2</u> ft)
	32				Massive well indicated					Fels pz quartz		54			SS	SS med.-grained, sub angular to subrounded - qtz. dominant
50	35				Fracs. 1 per inch							6/4				
					massive & well indicated					Fels hand		olive yellow				
52	23											alterat bands				
	4											3" to 1"				
54												thick of 54				
(3)												6/6				
56	5											olive yellow				
	3											and 2.54				
58												N5/5				
					Fracs. 2-4/ft.					cbn frag		gray				
60	2.4											2.54				
	4									abn band		N3/3				
					massive							very				
62												dark				
										cbn frag		gray				
64	5															
	3.5															
66	2.7															
(4)	4															

as not visibly different but
cement is calcareous
transition zone of
oxidized and unoxidized
rock 52' to 59'

2' of core recovered
was the 2' lost
from above

oxidized rock begins

1.5' of core recovered
was lost from previous
sample

ESE, Inc. BORE E-38 WELL(S)

PROJ. No.	DEPTH Feet	Recovery Int.	Width	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Features/ Grain Size			Lith. Char.	Lith. Class	Description/Comments
				Angle	Dip		10	20	Min	Major		cl	sd	gr			
											M G	01	10	100			
	90	2 1									2.5y N2/0 black						} 1' recovered was from previous sample
	92	0 4									2.5y N3/3 very dark gray						
	94																} 3' recovered was from previous sample
	96	5 1															
	98	5 5															
	100																
	102	5 5									2.5y N2/0 black						
	104	5 5									2.5y N5/0 gray						
	106																
	108	2 2															

SE, Inc. BORE E-38 WELL(S)

Fracture
mainly
fractured

massive
but
less
indurated
(only
slightly
less)

Clon
pennine

ck

Dr. David B.

no.

DEPTH Feet	Feet in	U S	Structure / Bedding		Hard-ness	Perm.		Mineralogy		Color	Texture / Grain Size Plot on gr mm	Lith. Char.	Lith. Class	Description / Comments
			Angle	Dip		1"	2"	Min	Major					
110	2.5									2.5% N5/0		sand to 30%	st	
112	4									grey				
114	5													
116	5													
118	5													
120	5													
122	2													
124	3													
126	2													

Massive

4" sand/clay

bedding

113' ss

fine grained

silt to 10%

117' cls

123.5
silty
sandy

124' ss

fine grained

.7' recovered was from previous sample

carbon following bedding planes and mottled throughout (1-4%)

NO. in DEPTH	U S	Structure/ Bedding		Hard- ness	Form		Mineralogy		Color	Texture/ Grain Size Foliation etc.	Lith. Char.	Lith. Class	Description/Comments
		Angle	Dip		1"	2"	Min	Max					
10	18								gray			SS	very carbon-rich
130	2								gray				
													130'
													END OF HOLE

Frontier Logging
Leadwood, Colorado

Mar. 10, 1987

Lasswood, Colorado

W
V
W

oo
m
,
ll

23A

Adams County

Colorado

opened by Linnton

Lakewood

Ground Level

REPORT OF THE
COMMISSIONER OF THE
LAND OFFICE

11312

29 Feb

22

51

三、

5/5	1
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 $1\frac{3}{4} - \frac{1}{4}$

2	3
---	---

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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2015/5/16

of 1000 ft.

5/24/95

9301/111

RESISTANCE

2.

WILLIAM C. CUMMIS

20

5:15 MV

1

5. **STANDARDIZATION**

RESISTANCE

50

OHMS 5 inches

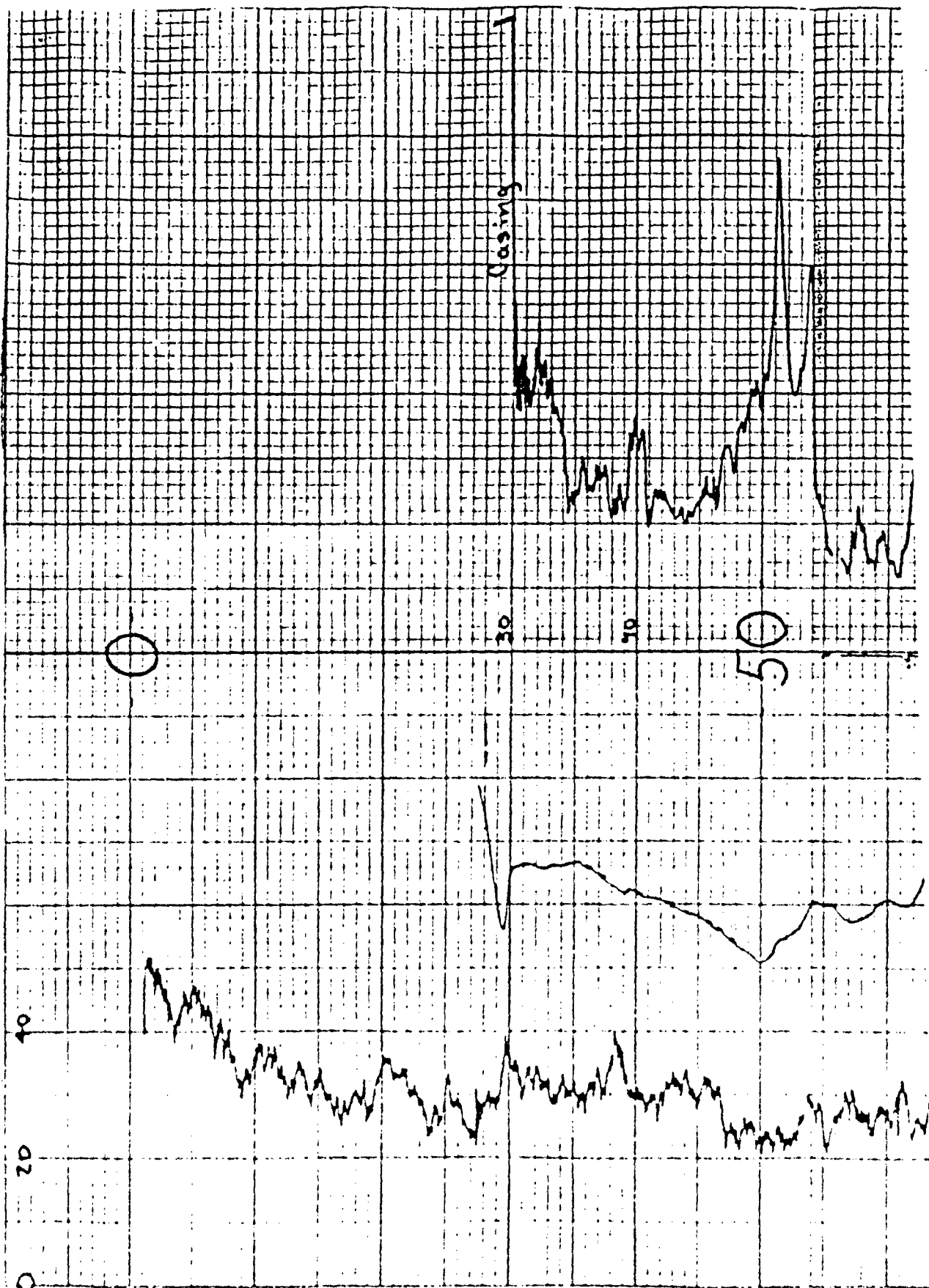
S.P.

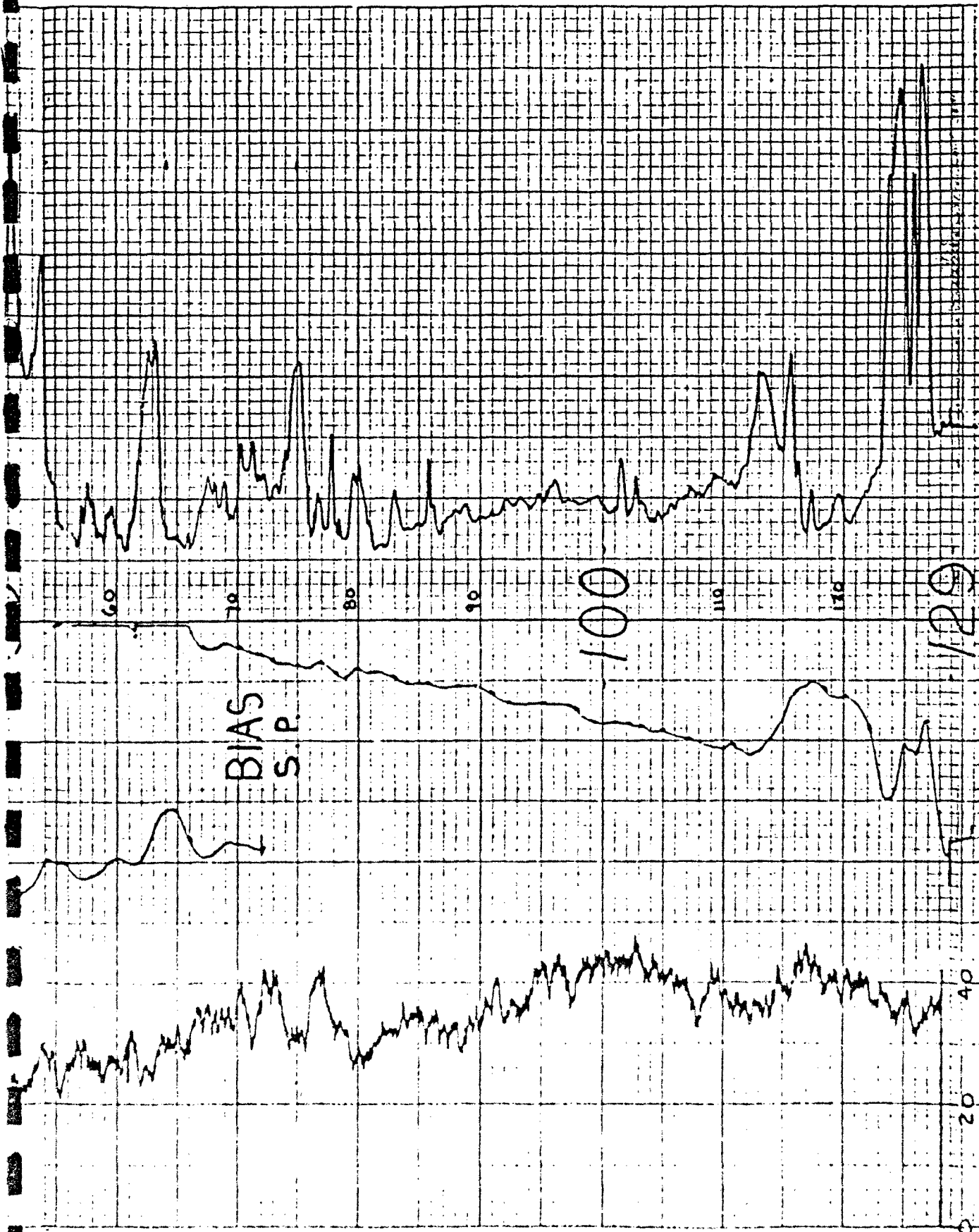
15 MV

20

40

FRONTIER LOGGING CORPORATION







COUNTS PER SECOND

NATURAL

GAMMA

S.P.

15 MV/INCH

RESISTANCE

50 OHMS/5 INCHES

HOLE E-38

Borehole: E-3901

Well: 37387

Depth-Feet	Soil/Rock Type	Well Completion	Description
		<p>The diagram shows a cross-section of the well. At the top, there is a casing. Below the casing, there is a seal. The well is filled with a sand pack. A screen is located at the bottom of the hole. Depth markers are shown on the right side of the well: 21', 24', 32.4', 36.78', and 42.66'. On the left side, there are depth markers: 5, 10, 15, 20, 25, 30, 35, 40, and 45. A horizontal line indicates the ground level.</p>	
5		6.55' 1st	
10		10.61' 1st	
15			
20			
25		20.66' 1st	
30			
35		32.4' 1st	
40		36.78' 1st	
45		42.66' 1st	
			8" casing TOP OF BENTONITE SEAL TOP OF SAND PACK TOP OF SCREEN BOTTOM OF HOLE, SCREEN

Drill Site Geologist: C. Deuser

Reviewed By: Joseph L. Reed

Date: 4.9.87

Date: 5/20/87

WELL CONSTRUCTION SUMMARY

Borehole E-3901 Well 37387
Project Name and Location MW Installation Project Number 1705307410
Drilling Company Boyles Driller B. Roach Rig Number Failing 25
Drilling Method(s) Rotary with mud (bentonite and water)

Borehole Diameter 12 1/4 in. _____ cm. _____ 0 ft. _____ cm. to 21 ft. _____ cm.
7 1/4 in. _____ cm. _____ 21 ft. _____ cm. to 42.66 ft. _____ cm.

Size(s) and types of Bit(s) 12 1/4" blade
bit, 7 1/4" blade bit

Sampling Method(s) not sampled

Size and Type PVC Schedule 40, 4"

Date/Time Start Drilling 4-8-87 0842

Total Borehole Depth 42.66 ft. _____ cm.

Date/Time Finish Drilling 4-8-87 0936

Depth to Bedrock 17 ft. _____ cm.

Date/Time Start Completion 4-8-87 0936

Depth to Water N.A. ft. _____ cm.

Date/Time Cement Protective Casing 4-8-87 1151

Water Level Determined By not determined

Materials Used _____

Length Plain PVC (total) 36.70 ft. _____ cm.

Plain PVC 4x10"

Length of Screen 5.88 ft. _____ cm.

Slotted PVC 1x5"

Total Length of Well Casing 44.36 ft. _____ cm.

Bentonite Pellets 1.5 buckets

PVC Stick Up 1.7 ft. _____ cm.

Bentonite Granular none 503 1/2 bag

Depth to Bottom of Screen 42.66 ft. _____ cm.

Cement 5 bags cement

Depth to Top of Screen 36.73 ft. _____ cm.

Sand 2 bags

Depth to Top of Sand 32.4 ft. _____ cm.

Water added during completion _____

Depth to Top of Bentonite 78 ft. _____ cm.

Water added during drilling _____

Total Gallons of water added _____

Drill Site Geologist C. Benson

Date 4-9-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 05/08/87 1250 SMH PJB

Date/Time/Personnel Casing Painted 05-12-87 0800 SMH PJB

Date/Time/Personnel Numbers Painted 05-12-87 1255 SMH PJB

Materials Used 10 Bags Quickcrete 1 All Lawl Edging

Top of Protective Casing to Top of PVC 0.25 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 0.51 ft. _____ cm.

Top of Protective Casing to Internal Mortar 0.52 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 1.95 ft. _____ cm.

Top of Protective Casing to Ground Level 1.95 ft. _____ cm.

Reviewed By Joseph L. Reel Date 6/19/87

Drill Site Geologist _____ Date _____

Borehole: E39D2

Well: 37388

Depth-Feet	Soil/Rock Type	Well Completion	Description
5		Point 17.54	
10		Point 18.51	
15			
20		Point 19.55	20' 12" steel casing
25			
30		Point 21.59	
35		Controlled 30'	
40		Point 23.64	
45			45' 8" steel casing
50		Point 24.68	
55			
60		Point 25.72	TOP OF BENTONITE SEAL 57.6
65			TOP OF SAND PACK 64.2
70			TOP OF SCREEN 69.78
75			
80			
85			Total Depth 86'
90			

Drill Site Geologist: C. Bensen
Reviewed By: Joseph K. Reed

Date: 4/11/87
Date: 5/20/87

WELL CONSTRUCTION SUMMARY

Borehole E39 D2 Well 37388
Project Name and Location MW Installation Project Number 1705207410
Drilling Company Boyles Driller B. Roach Rig Number Falling 25
Drilling Method(s) Rotary sampling with bentonite mud

Borehole Diameter 11 1/2 in. 0 ft. 20 ft.
11 1/2 in. 40 ft. 45 ft.
7 7/8" 45 to 86"

Size(s) and types of Bit(s) 11 1/2" blade, 11 1/2" blade and 7 7/8" blade bit

Sampling Method(s) not sampled

Date/Time Start Drilling 4-10-87 0737

Size and Type PVC 4" schedule 40

Date/Time Finish Drilling 4-10-87 0910

Total Borehole Depth 86 ft. cm.

Date/Time Start Completion 4-10-87 0910

Depth to Bedrock 17 ft. cm.

Date/Time Cement Protective Casing 4-10-87 1212

Depth to Water ft. cm.

Materials Used

Water Level Determined By

Plain PVC 3 x 10 5 x 1

Length Plain PVC (total) 71.48 ft. cm.

Slotted PVC 1 x 10 1 x 5

Length of Screen 16.22 ft. cm.

Bentonite Pellets 7 buckets

Total Length of Well Casing 87.7 ft. cm.

Bentonite ^{powder} Granular 1 bag

PVC Stick Up 1.7 ft. cm.

Cement 13 bags

Depth to Bottom of Screen 86 ft. cm.

Sand 2 1/2 bags

Depth to Top of Screen 64.78 ft. cm.

Water added during completion -

Depth to Top of Sand 64.7 ft. cm.

Water added during drilling -

Depth to Top of Bentonite 51.8 ft. cm.

Total Gallons of water added -

Drill Site Geologist C Pearson

Date 4-10-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 05/08/87 1330 SMH PJB

Date/Time/Personnel Casing Painted 05-12-87 0800 PJB/SMH

Date/Time/Personnel Numbers Painted 05-12-87 14:00 PJB/SMH

Materials Used

Top of Protective Casing to Top of PVC	<u>2.26</u> ft. <u>cm.</u>	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>1.46</u> ft. <u>cm.</u>	
Top of Protective Casing to Internal Mortar	<u>1.46</u> ft. <u>cm.</u>	
Top of Protective Casing to Top of Cement Pad	<u>1.85</u> ft. <u>cm.</u>	
Top of Protective Casing to Ground Level	<u>1.96</u> ft. <u>cm.</u>	

Reviewed By Joseph L. Reed Date 6/4/87

Drill Site Geologist _____ Date _____

BOREHOLE SUMMARY LOG

Borehole E 39A Well FRANCE/IANE
Project Name and Location T-36 1/4 MILE N OF 96TH ST ALONG R. SECTION Project Number
Drilling Company Boyles Bros Driller Dave Jarvis Rig Number 5451
Drilling Method(s) Auger

Size(s) and type(s) of bit(s)
Borehole Diameter 8 in. cm. ft. cm. to ft. cm.
 in. cm. ft. cm. to ft. cm.

Sampling Methods CONTINUOUS Split Spoon

Total Number Soil Sampling Tubes 10 - 2 FT

Total Number Core Boxes 2

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 3/25/07 0815

Date/Time Completed Drilling 3/25/07 0915

Total Borehole Depth 20' ft. cm.

Depth to Bedrock 17' ft. cm.

Depth to Water 19' ft. cm.

Water Level Determined By? SAMPLES

Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 3/25/07 1035

Depth of Tremmie Pipe 50'

Gallons of Grout 50

Materials Used 3 BAGS OF CEMENT / 16 LBS ARMYTITE

Comments 20' OF 4" PVC GROUTED IN PLACE TO BE USED AS
SUCKER CASING FOR EXPLORATORY BORING E-39

Wellsite Geologist Greg Curtis Date 3/25/07

Checked for Grout Settlement on 4/28/87 by JLR

Amount of Grout Added

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 4/28/87

Drill Site Geologist Date

Borehole: E 39 A

Well Number: Dry Hole

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
MUNSELL Colors					
1.5	0-2'	2'	NA	0-2'	ML
	2-4'	1.2'		2-4'	
6.5	4-6'	2'		4-6'	SM
	6-7'	0.9'		6-7'	
7.0	7-9'	1.25'		7-9'	
8.0	9-11'	1.25'		9-11'	
<p><u>ML</u> sandy-silt, ~20-30% i.f. gr. sand, 10YR, 4/3-4, dk. yash. brn., non-pls., loose, moist, alluvium.</p> <p>At 1.5' color changes to 10YR, 6/3-4, pale brn., natural density increases to med. dense, moisture decreases to dry.</p> <p><u>SM</u> silty-sand, ~30-40% silt, 10YR 5/4-6, yash. brn., non-pls., loose, moist alluvium.</p> <p>At 6.5' percent silt decreases to ~20%, color changes to 10YR, 6/6-8, brnch. yellow.</p>					

Drill Site Geologist: A. S. Patten

Date: 3/27/87

Reviewed By: Joseph L. Reid

Date: 4/16/87

Borehole: E 39.4

Well Number: Dry Hole

SOILS LOG
Description

Munsell Colors

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
			NA		ML	ML sandy-silt, ~ 30% v. f. gr. sand, 10YR 5/6-8, grayish-bm; non-plas., loose, moist alluvium.
	11-13'	1.7'		11-13'	SC	SC clayey-sand, ~ 20-30% clay, 10YR 5/3-4, brown, slight plas., v. soft, moist, alluvium.
	13-15'	1.2'		13-15'		At 14.0', percent clay increases to ~ 40%, color changes to 10YR 6/3-4, pale br.
	15-17'	2'		15-17'		At 16.0' color changes to 10YR 5/2-3, grayish br.
	17-19'	2'		17-19'	CL	CL sandy-clay, ~ 5-10% v. f. gr. calc. sand, 10YR 5/1-2 grayish br., low plas., soft, moist bedrock.
	19-20'	1'		19-20'	WT	At 19.0' moisture increases to saturated.
END OF BORING LOG -						
AKO						

Drill Site Geologist: [Signature]

Date: 3/27/87

Reviewed By: [Signature]

Date: 4/16/87

BOREHOLE SUMMARY LOG

Borehole E-39 Well -
Project Name and Location MW Installation Project Number 17052 07410
Drilling Company Bayus Driller B Roach Rig Number Failing 25
Drilling Method(s) Rotary - drill mud used
Size(s) and type(s) of bit(s) 3 7/8" tricone bit
Borehole Diameter 3 7/8 in. cm. 2 ft. cm. to 130 ft. cm.
 in. cm. ft. cm. to ft. cm.
Sampling Methods continuous core
Total Number Soil Sampling Tubes -
Total Number Core Boxes 14
Number of Gallons Lost Drilling Fluid ~ 1400 gals. - water lost 50'
Date/Time Started Drilling 4-2-87 1109
Date/Time Completed Drilling 4-3-87 1640
Total Borehole Depth 130 ft. cm.
Depth to Bedrock 17 ft. cm.
Depth to Water unknown ft. cm.
Water Level Determined By? A.A.
Borehole Completed as Monitoring Well? NO
Date/Time Grouting Completed 4-6-87 1330
Depth of Tremmie Pipe 125'
Gallons of Grout 95
Materials Used 9 1/2 bags cement, 9/10 bag bentonite, 95 gals water
Comments hdc grouted to surface
Wellsite Geologist C Benson Date 4-6-87
Checked for Grout Settlement on 6/11/87 by JRL
Amount of Grout Added 0
All Measurements from Ground Level
Reviewed by Joseph L. Reed Date 6/11/87
Drill Site Geologist Date

Depth (ft)	True Vertical Depth (ft)	Structure/ Bedding		Hard- ness	Porosity		Mineralogy		Color	Grain Size (mm)	Lith. Char	Lith. Class	Description/Comments
		Angle	Dip		%	Core	Min	Matrix					
													C-20' Logged on soil Log Form
20													
22	4.2 4								2.54 6/4 light yellowish brown			CL	Claystone
24													
26	2.8 4												
28													
30	5.2 5												
32													
34	2.5 5												
36													
38													
40													
42													
44													
46													
48													
50													
52													
54													
56													
58													
60													
62													
64													
66													
68													
70													
72													
74													
76													
78													
80													
82													
84													
86													
88													
90													
92													
94													
96													
98													
100													

E, Inc. BORE E-39 WELL(S)

20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
52
54
56
58
60
62
64
66
68
70
72
74
76
78
80
82
84
86
88
90
92
94
96
98
100

①

②

0

Massive
↓

Curved
fracture
↓

20'
st
sandy-
sand
10%

No Recovery

Massive

CL

Claystone

(ft)	I P	S	Structure / Bedding	Mineralogy	Color	Lith Class	Lith Class	Description / Comments
78					2.5y R3/0 very dark	SS	CL	Claystone interbed
80						SS	SS	SANDSTONE silt, silt and clean siltstone and claystone interbeds 2-4" thick
82								
84								
86								
88								
90						CL	CL	CLAYSTONE INTERBED
92						SS	SS	SANDSTONE with siltstone and claystone interbeds 2-4" thick
94								
96								

WELLS

BORE E-39

INC

Core No.	Core Depth ft	Core Interval ft	Core Description	Core Notes	Core Remarks	Core Color	Core Grain Size	Core Lith Class	Core Lith Class	Core Description / Comments
98	5 1/2									
	100									
99	5 1/2									
102	5									
	104									
	106									
	108									
	110									
10										
	112									
	114									
	116									

ESSE, Inc. BORE WELL(S)

Alps shale
Friable
extraneously
fractured
friable
massive
friable

Chm
to
5%
massive
mottled
dark
gray
Col.
cite
valley
bricks
&
Ocean
xstals
mass.
Pis
thin
YH
Silt
19%
Chm
to
7%
Chm
5%

2.5%
W/S
very
dark
gray
Silt
70-80%
(avg)
Sands
to
50%
Silt
5%

CL
CLAYSTONE
Silty with clayey areas
mottled throughout
SS
SILTSTONE, SANDSTONE
interbedded
CL
CLAYSTONE

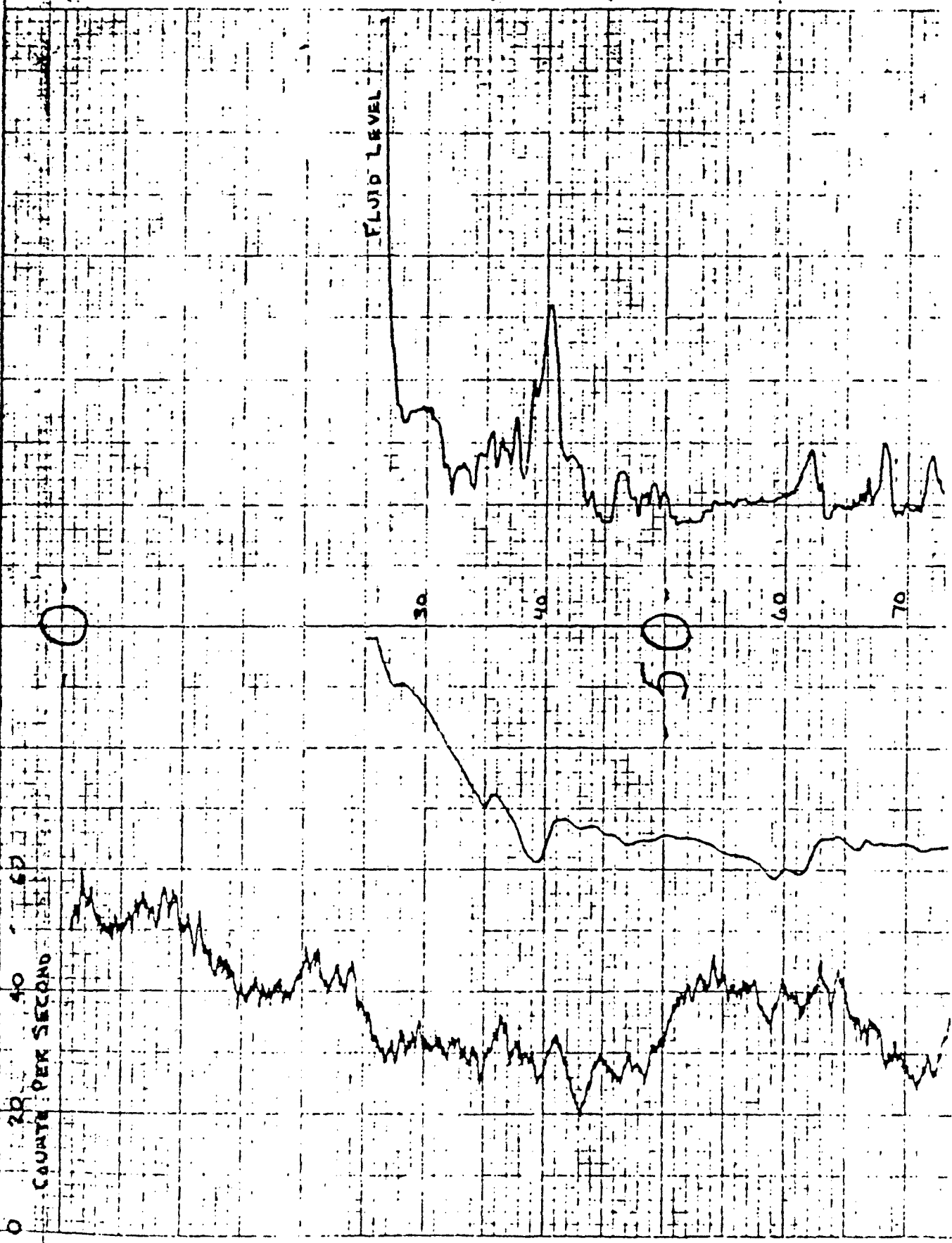
(113)	E	Angle	Bedding	Mineralogy	Color	Lith. Class	Lith. Class	Description/Comments
118	5 1/4			thin 2%	2.54 N3/0	CL	CL	CLAYSTONE
120					very dark gray	SS	SS	SANDSTONE with siltstone & occasional claystone interbeds
122	5 1/5		cross bedding and fine bedding perpendicular to core long axis	thin to 3 1/2% to 4%				carbon mottled through core and following bedding planes
124								
126	4 1/5							
128								
130								END OF CORING AT 130'

USE BORE WELL(S)

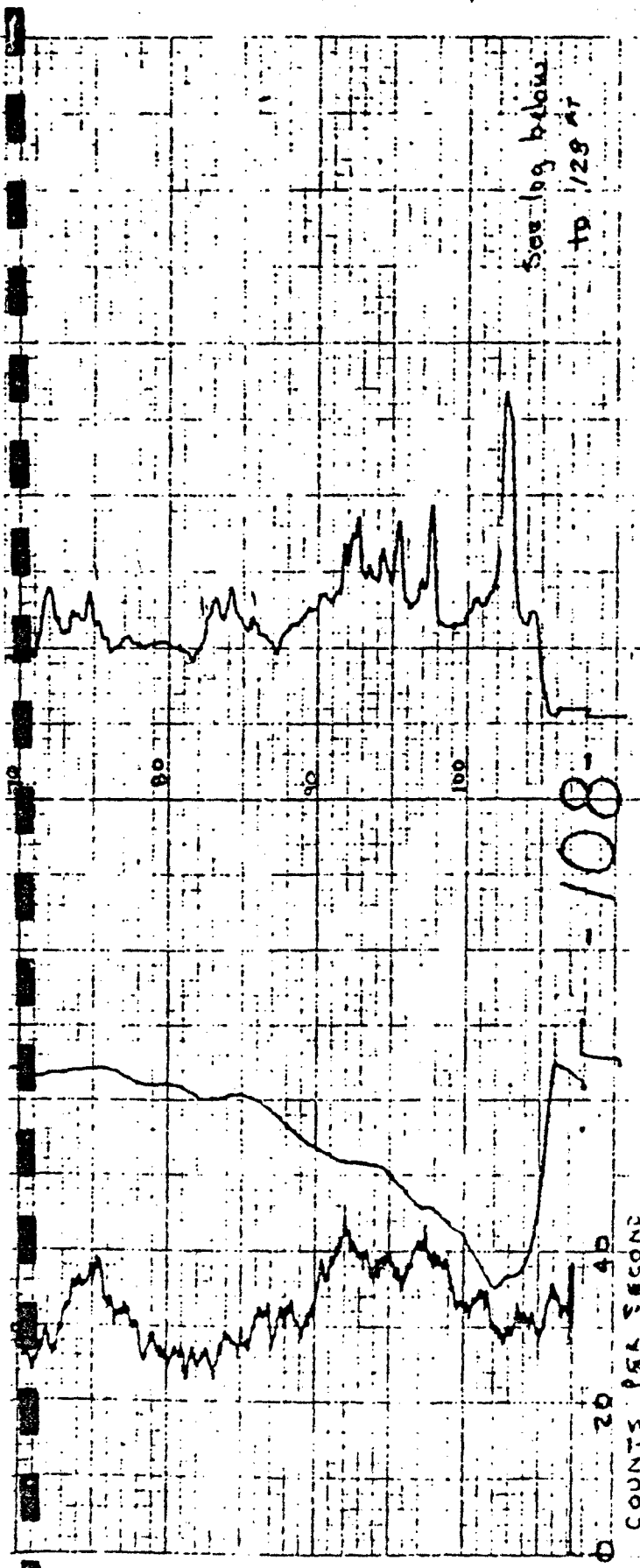
UNITS

MAN

Log



140 0017102



NATURAL GAMMA S.P. 20 MV/INCH

RESISTANCE 50 OHMS/5 INCHES

E-39

0

50



DRILL PIPE TO SURFACE

INSIDE

OPEN HOLE

20
COUNTS PER SECOND

NATURAL
GAMMA

5 P

20 MV/INCH

100

DRILL PIPE

128

RESISTANCE

40 OHMS/5 INCHES

HOLE E-39

WELL CONSTRUCTION SUMMARY

Borehole E40A Well 3737D
Project Name and Location RMA offsite Project Number _____
Drilling Company Boyles Bros. Driller D. Jarvie Rig Number B57
Drilling Method(s) continuous core

Borehole Diameter 12 1/4 in. _____ cm. _____ ft. _____ cm. to 25.8 ft. _____ cm.
~~10~~ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) 3 1/4" hollow stem
auger

Sampling Method(s) continuous core

Size and Type PVC 4" schedule 80

Date/Time Start Drilling 1-21-87 0919

Total Borehole Depth 27 ft. _____ cm.

Date/Time Finish Drilling 1-21-87 1101

Depth to Bedrock 25.8 ft. _____ cm.

Date/Time Start Completion 1-21-87 1152

Depth to Water 9 ft. _____ cm.

Date/Time Cement Protective Casing 1-21-87 1435

Water Level Determined By field observation

Materials Used 7-4" tubes
1 10" piece cas

Length Plain PVC (total) 7.1 ft. _____ cm.

Plain PVC 2 10" piece

Length of Screen 21.41 ft. _____ cm.

Slotted PVC 2 10" piece

Total Length of Well Casing 28.5 ft. _____ cm.

Bentonite Pellets 50 gal.

PVC Stick Up 2.7 ft. _____ cm.

Bentonite Granular 10 lb.

Depth to Bottom of Screen 25.8 ft. _____ cm.

Cement 1 bag

Depth to Top of Screen 4.4 ft. _____ cm.

Sand 13 1/2 bags

Depth to Top of Sand 3 ft. _____ cm.

Water added during completion 30 gal.

Depth to Top of Bentonite 2 ft. _____ cm.

Water added during drilling 0

Total Gallons of water added 30 gal.

Drill Site Geologist C.D. Benson

Date 1-21-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 2/10/87 10106 JWF KWP

Date/Time/Personnel Casing Painted 2/10/87 1315 KWP

Date/Time/Personnel Numbers Painted 4/15/87 1115 JWF BAL

Materials Used 10 bags Quikrete

Top of Protective Casing to Top of PVC 0.6 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.34 ft. _____ cm.

Top of Protective Casing to Internal Mortar 2.4 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 3.05 ft. _____ cm.

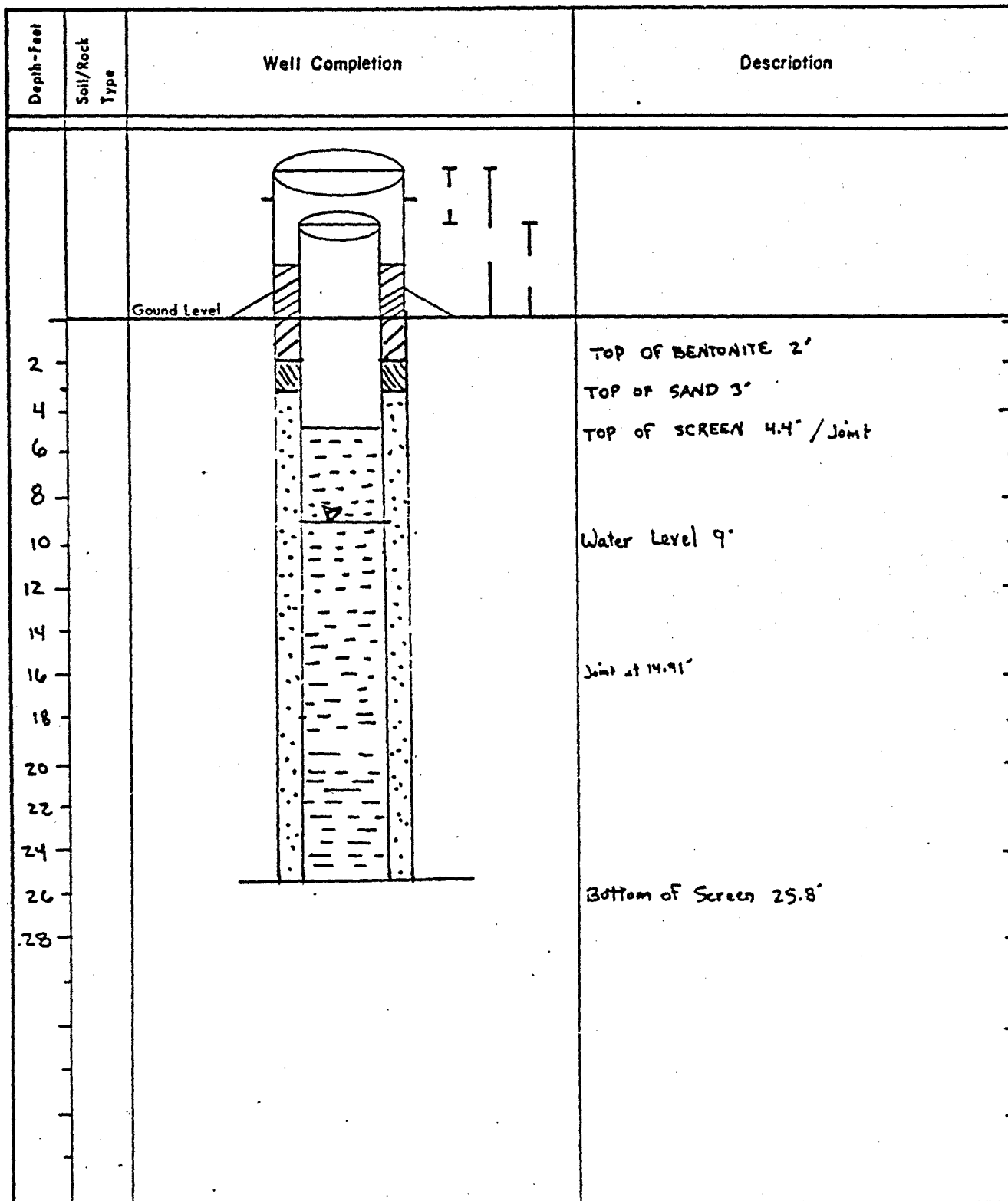
Top of Protective Casing to Ground Level 3.05 ft. 3.30 cm.

Reviewed By Joseph L. Reed Date 6/11/87

Drill Site Geologist _____ Date _____

Borehole: E40A

Well: 37370

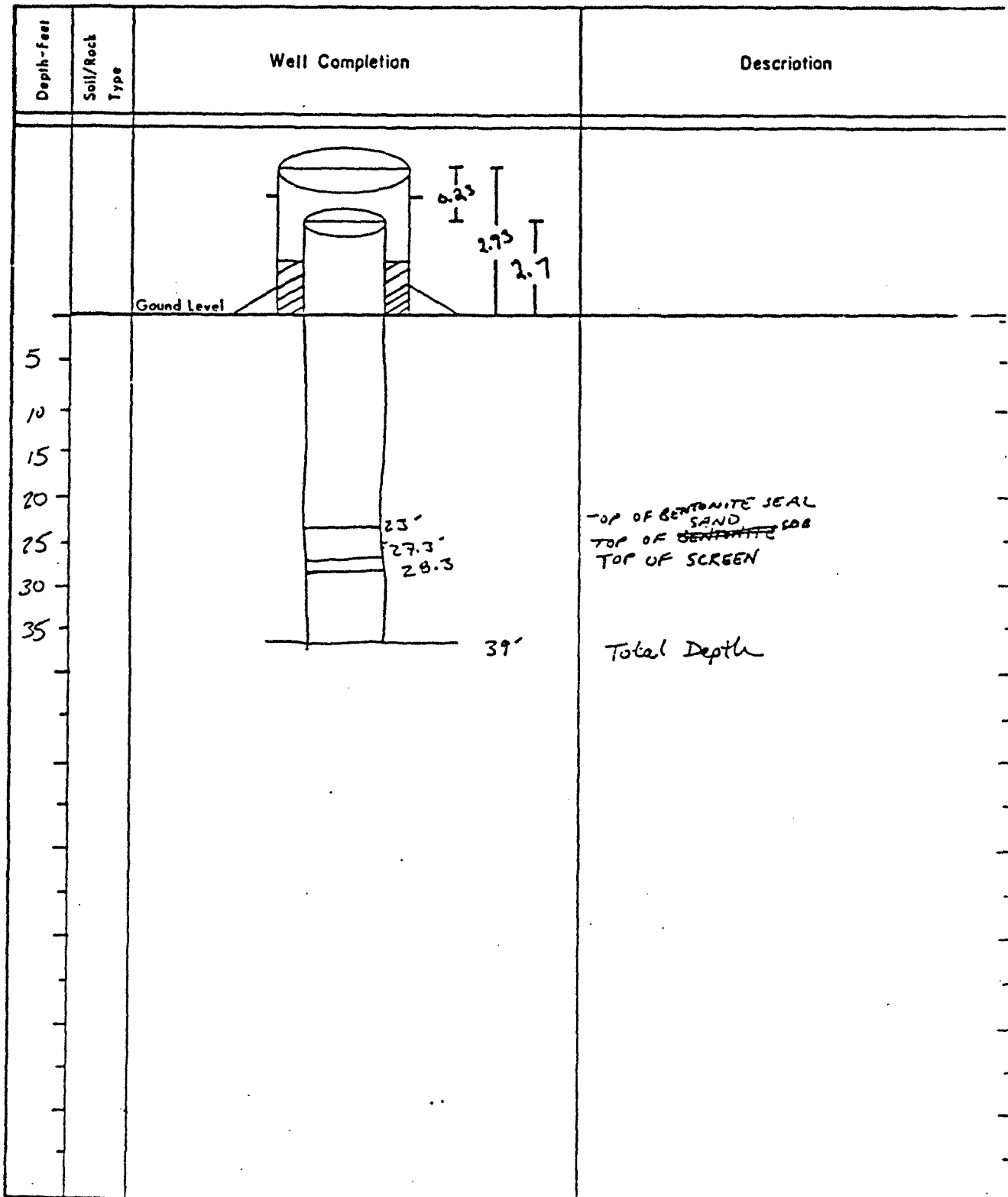


Drill Site Geologist: C.D. Benson
Reviewed By: Joseph L. Reed

Date: 1-21-87
Date: 6/11/87

Borehole: 340 Piezometer

Well: 37371



Drill Site Geologist: C. D. Benson
Reviewed By: Joseph L. Reed

Date: 7-6-87
Date: 7/9/87

WELL CONSTRUCTION SUMMARY

Borehole E40 Piezometer Well 37371
Project Name and Location offpost monitor well Project Number _____
Drilling Company Boyles Driller B. Roach Rig Number 760
Drilling Method(s) Conventional Core

Borehole Diameter 7 7/8 in. _____ cm. 0 ft. _____ cm. to 39 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) 7 7/8

Sampling Method(s) NA

Size and Type PVC 2" Schedule 40

Date/Time Start Drilling 2-5-87 1023

Total Borehole Depth 39 ft. _____ cm.

Date/Time Finish Drilling 2-5-87 1512

Depth to Bedrock 27 ft. _____ cm.

Date/Time Start Completion 2-5-87 1536

Depth to Water 7 ft. _____ cm.

Date/Time Cement Protective Casing 2-6-87 1105

Water Level Determined By visual

Materials Used _____

Length Plain PVC (total) 34.36 ft. _____ cm.

Plain PVC 3 x 10" 1 x 5"

Length of Screen 10.63 ft. _____ cm.

Slotted PVC 1 x 10"

Total Length of Well Casing 44.99 ft. _____ cm.

Bentonite Pellets 1 bucket

PVC Stick Up 2.7 ft. _____ cm.

Bentonite Granular 1 bag

Depth to Bottom of Screen 39 ft. _____ cm.

Cement 7 bags

Depth to Top of Screen 28.3 ft. _____ cm.

Sand 3 bags

Depth to Top of Sand 27.3 ft. _____ cm.

Water added during completion none

Depth to Top of Bentonite 23 ft. _____ cm.

Water added during drilling none

Total Gallons of water added none

Drill Site Geologist C.D. Buser

Date 2-6-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 2/10/87 JWF

Date/Time/Personnel Casing Painted JWF BAG 4/15/87 1049

Date/Time/Personnel Numbers Painted JWF BAG 4/15/87 1049

Materials Used 13 Bags Quickrete

Top of Protective Casing to Top of PVC 0.23 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.13 ft. _____ cm.

Top of Protective Casing to Internal Mortar 2.19 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 2.57 ft. _____ cm.

Top of Protective Casing to Ground Level 2.93 ft. _____ cm.

Reviewed By Joseph L. Reed Date 7/9/87

Drill Site Geologist _____ Date _____

WELL CONSTRUCTION SUMMARY

Borehole E40 DE Well JR 373 37372
 Project Name and Location MW Installation - off post 96th Ave. Project Number _____
 Drilling Company Boyle Driller B. Roach Rig Number TH-60
 Drilling Method(s) Continuous wire

Borehole Diameter 7 7/8 in. _____ cm. 0 ft. _____ cm. to 96.3 ft. _____ cm.
 _____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) 7 7/8" OD

Sampling Method(s) Continuous core

Size and Type PVC 4" schedule 40

Date/Time Start Drilling 1-23-87 1051

Total Borehole Depth 43.5 ft. 96.3 cm.

Date/Time Finish Drilling 1-29-87 1404

Depth to Bedrock 26 ft. _____ cm.

Date/Time Start Completion 1-3-87 0736

Depth to Water 9 ft. _____ cm.

Date/Time Cement Protective Casing 2-5-87 1300

Water Level Determined By visual

Materials Used 10 CORE BOXES

Length Plain PVC (total) 33.32 ft. 73.04 cm.

Plain PVC 20.32 (7:10')

Length of Screen 26.94 ft. cm.

Slotted PVC 26.96 (2:10', 1:5')

Total Length of Well Casing 27.38 ft. 99 ft. 100 cm.

Bentonite Pellets 4 buckets

PVC Stick Up 2.2 ft. _____ cm.

Bentonite Granular 4 buckets

Depth to Bottom of Screen 38.5 ft. _____ cm.

Cement 26 bags

Depth to Top of Screen 66.5 ft. _____ cm.

Sand 7 bags

Depth to Top of Sand 60.5 ft. _____ cm.

Water added during completion _____

Depth to Top of Bentonite 56 ft. _____ cm.

Water added during drilling _____

Total Gallons of water added _____

Drill Site Geologist C.D. Benson

Date 2-5-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 2/10/87 0930 Jwf KWP

Date/Time/Personnel Casing Painted 2/10/87 1400 KWP

Date/Time/Personnel Numbers Painted 4/5/87 1100 JWF BAb

Materials Used 10 BAGS QUICKCRETE

Top of Protective Casing to Top of PVC 0.43 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.91 ft. _____ cm.

Top of Protective Casing to Internal Mortar 3.15 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 2.35 ft. _____ cm.

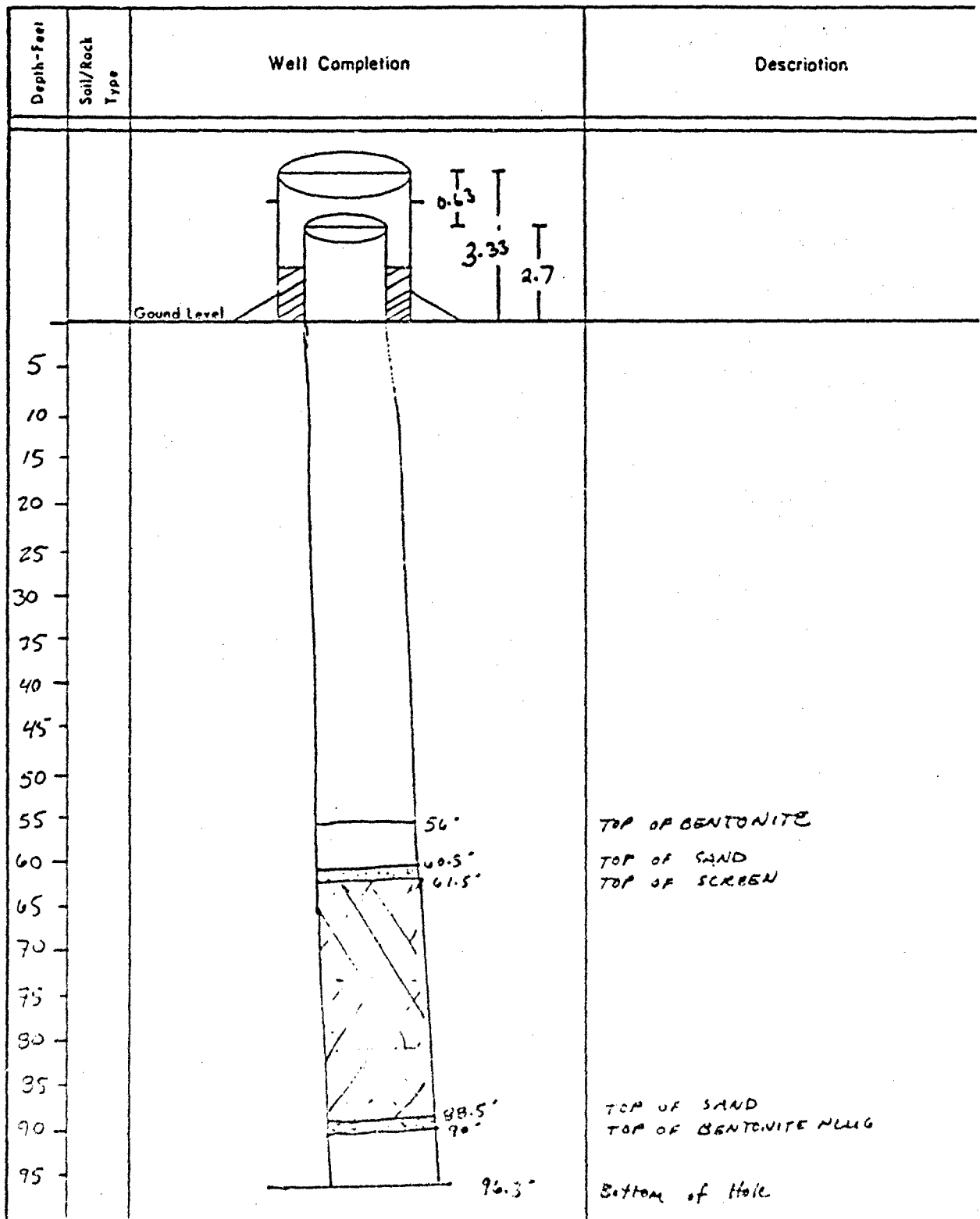
Top of Protective Casing to Ground Level 3.35 ft. _____ cm.

Reviewed By Joseph L. Reed Date 6/11/87

Drill Site Geologist _____ Date _____

Borehole: E40D

Well: 37372



Drill Site Geologist: C.D. Benson
Reviewed By: Joseph L. Reed

Date: 2.5.87
Date: 7/9/87

Borehole: E40A

Well Number: E40A 37370

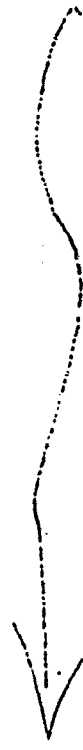

SOILS LOG						Description
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
0.0	0'-2'	2'	NA	0'-2'	SM	<u>SM</u> - Silty sand, sl. clay, 10 yr 3/3, dk. brown, med. dense, nonplast, sl. moist alluvium
2.0	2'-4'	1.8'		2'-6'	SC	<u>SC</u> clayey sand, 25% clay, 10 yr 3/1, very dk. gray, med stiff, med plast, sl. moist alluvium
4.0	4'-6'	2'				
6.0	6'-8'	1.2'			SM	<u>SM</u> Silty sand, = 20% coarse sand, 10 yr 3/1 med dense, nonplast, moist
8.0	8'-10'	2'				- moisture change to saturated at 9' (w.T)
10.0	10'-12'	2'		10'-12'	SW	<u>SW</u> coarse sand, 10 yr 4/3, brown, med dk nonplast, saturated
11.0						

Drill Site Geologist: C. D. Peterson

Date: 1-22-87

Borehole: E40.1

Well Number: 37370


SOILS LOG						Description
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
11.0	10		NA	10	SW	<p>SW - well-graded sands, gravelly sands 5% gravel, 10% 1/3, brown/dk. brown, med dense, non plast, saturated</p> 
	12	2'		12		
12.0						
	12			12		
13.0						
	14	2'		14		
14.0						
	14			14		
15.0						
	16	1.8'		16		
16.0						
	16			16		
17.0						
	18	1.6		18		
18.0						
	18			18		
19.0						
	20	1.8'		20		
20.0						<p>20' increase in % gravel to 30% Gravelly Sands</p> 
	20			20		
21.0						
	22	7'		22		
22.0						

Drill Site Geologist: C. D. Glycer

Date: 1.22.87

Borehole: E40.A

Well Number: 37370

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
22.0	22'		NA		SW	<u>SW</u> gravelly sands 30-40% gravel, 10yr 4/2 dk. grayish brown, med dense even plast, saturated 
23.0	24' 1'	(take stuff)				
24.0	24' 1'					
25.0	26' (take stuff)					BEDROCK - weathered claystone 10yr 4/3 dk. brown
26.0	27' 1'					
27.0						END OF BORING - REAMED TO 26' 27'

Drill Site Geologist: L.D. Engstrom

Date: 1.22.87

[illegible]

Box No.	DEPT I	Roc. Int.	Weight	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color (M) G	Texture/ Grain Size clst ad gr mm .01 .10 100	Lith. Char	Lith. Class	Description/Comments
				Angle	Desc.		1°	2°	Min	Habit					
40				U S										SS	40.3
42	5.0 5.0										2.5Y N3/0 dk. gray		cbn		
44											2.5Y N1/0 lt. gray		silty		
46	8.0 4.0										?		? N.R.	? N.R.	No recovery
48	1.0 1.0										2.5Y N4/4 dk. gray				
50	2.0 2.0												clay stone shale		
52															
54	1.1 3.6														
56	1.9 2.7														
58	7.7 1.4												loose	SS	57.9 noncem. loose sand, possibly same slough from up hole? 58.6

ESE, Inc. CORE LOG

By

MG

Date

2/6/87

BORE

E40D

Well(s)

Page

3 of 4

BOX NO.	DEPTH Feet	Roc Int.	Swath	Structure/ Bedding		Hard- ness	Perm.		Mineralogy	Color	Texture/ Grain Size clay sd gr mm .01 .10 100	Lith. Char.	Lith. Class	Description/Comments	Feet
				Angle	Desc.		1°	2°							
60			U S			S	H	L	H	Min	Mod	M	G		
	62	5.0 5.0			brkn							2.5Y M6/0 gray		laminat clay rich	St
	64														
	66	5.0 5.0													
	68				Eng. CE vault br? cem. box?										
	70	1.2 1.2													
	72	4.8 4.8			brkn							gray brn 2.5Y 5/2		inter- bedded clay silt	St
	74														
	76	2.7 2.7										2.5Y N4/0 R2 gray		silty	SS
	78														

WELL(S)

BORE E40D

Inc.

BOX NO.	DEPTH FEET	CORRECTION FEET	U	S	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture/ Grain Size	Lith. Char.	Lith. Class	Description/Comments	
					Angle	Desc.		1"	2"	Min	Habit					Scale 1" = 2' (1)	
	80																80
	82	5.0 5.0												cbn- silty	sh	81.0	
	84	1.7 1.7												silty clayey	ss	84.2	82
	86	5.0 5.0												sandy clayey	st	predom. siltstone w/ some sandy component and thin 1-2" clay lenses	86
	88													silty	ss	87.5 88.2	88
	90													shaly	st	91.0	90
	92	4.6 4.6												silty	sh		92
	94																94
	96	2.3 2.3															96
	EOH															EOH = 96.3 ft.	
	98																

Inc. BORE E40D WELL(S)



Frontier Logging
Lakewood, Colorado

ESE

E 40 DENVER

Date JAN. 28, 1987

Driller Depth	55 Ft	Start Hour Trip	40
Bit Size	3 Inch	Time In	1220
Casing Outer	28 Feet	Time Out	1250
Fluid in Hole	Water	Unit No.	110
Density Viscosity	fm	Operator	Wm. Linton
Drilling Measured From	Ground Level	Location	Lakewood, CO

ADAMS COUNTY

State COLORADO

Log Measured From

Ground Level

NATURAL GAMMA RADIATION
(measured log off scale)

EQUIPMENT DATA

TO LOGGED	52 Feet	Scale	TC	CPM	Logging Speed	TC	CPM	Logging Speed	TC	CPM	Logging Speed
Natural Gamma	200 Scale = 20	CPM per inch	From	To	Sec	From	To	Sec	From	To	Sec
Time Constant	2	Sec	From	To	Sec	From	To	Sec	From	To	Sec
Cable Source	15	ft	From	To	ft	From	To	ft	From	To	ft
Cable Source	15	ft	From	To	ft	From	To	ft	From	To	ft

Probe	103-	Probe Diameter	1 5/8"	Density Source No	
Probe Type	xtal	Probe Length	3/4 x 1"	Type	
Probe Factor	2.35 x 10 ⁻⁵	Probe Time	7	CPM/sec	
Casing Factor	1.07	Casing Time	3 Inch	Temperature	
RESISTANCE	75 ohms/5"	Dens per 5 inches		DIRECTIONAL DATA	
S.P.	20 MV / Inch	SP per inch		Closure	
				Azimuth	
				True Vertical	
				Survey Depth	



75

OHMS/ 5 inches



25

0 20 40
COUNTS PER SECOND

NATURAL

GAMMA

S.P.

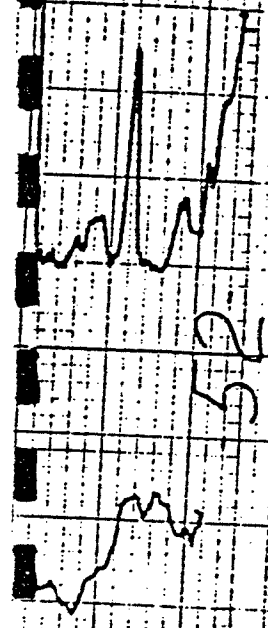
20 MV/INCH

RESISTANCE

75 OHMS/5 INCHES

E 40 DENVER

52



WELL CONSTRUCTION SUMMARY

Borehole E42A Well 37369
Project Name and Location RMA Offsite Well Installation Project Number 1705804510
Drilling Company Boyles Bros Driller D. Jarvis Rig Number B57
Drilling Method(s) Continuous core

Borehole Diameter 12 1/4 in. _____ cm. 0.0 ft. _____ cm. to 25.26 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) 3 1/4" hollow stem auger Sampling Method(s) Continuous core

Size and Type PVC 4" Schedule 40 Date/Time Start Drilling 1/19/87 1115

Total Borehole Depth 25.26 ft. _____ cm. Date/Time Finish Drilling 1/19/87 1239

Depth to Bedrock 25.0 ft. _____ cm. Date/Time Start Completion 1/19/87 1402

Depth to Water 5.0 ft. _____ cm. Date/Time Cement Protective Casing 1/19/87 1545

Water Level Determined By Field Observ Materials Used _____

Length Plain PVC (total) 6.68 ft. _____ cm. Plain PVC 1-10'

Length of Screen 21.21 ft. _____ cm. Slotted PVC 2-10'

Total Length of Well Casing 27.89 ft. _____ cm. Bentonite Pellets 1 bucket

PVC Stick Up 2.7 ft. _____ cm. Bentonite Granular 5#

Depth to Bottom of Screen 25.26 ft. _____ cm. Cement 1 bag

Depth to Top of Screen 4.05 ft. _____ cm. Sand 13 1/2 bags

Depth to Top of Sand 3.0 ft. _____ cm. Water added during completion 0

Depth to Top of Bentonite 2.0 ft. _____ cm. Water added during drilling 0

Drill Site Geologist D.A. Morgan Total Gallons of water added 0

Date 1/19/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed _____

Date/Time/Personnel Casing Painted _____

Date/Time/Personnel Numbers Painted _____

Materials Used _____

Top of Protective Casing to Top of PVC _____ ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole _____ ft. _____ cm. _____

Top of Protective Casing to Internal Mortar _____ ft. _____ cm. _____

Top of Protective Casing to Top of Cement Pad _____ ft. _____ cm. _____

Top of Protective Casing to Ground Level _____ ft. _____ cm. _____

Reviewed By _____ Date _____

Drill Site Geologist _____ Date _____

Borehole: 542A

Well: 37369

Depth-Feet	Soil/Rock Type	Well Completion	Description
0			
2			Top of Bentonite (2.0)
3			Top of Sand (3.0)
4			Top of Screen (4.05) / Joint
6			Water Level (5.0)
8			
10			
12			
14			
16			
18			
20			
22			
24			
25.26			Bottom of Screen (25.26)

Drill Site Geologist: D.A. Mearns
Reviewed By: _____

Date: 1/19/87
Date: _____

Borehole: E 42 A Well Number: E 42 A 37369

SOILS LOG
Description

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
0.0			N4			
1.0	0-0	2'		0-2'	SC	<u>SC</u> , clayey sand, 20% clay, 10 yr 3/1 v. drk gray, med. stiff, med. plast, moist alluvium (roots present 0-.4')
2.0						
3.0	1-0	2'			SM	<u>SM</u> , silty sand, 30% silt, 10 yr 3/4, drk gray br. med. dense, non-plast moist alluvium.
4.0						moisture increase to wet
5.0	2-0	2'			SM	moisture change to sat at 5.0' (w.t.)
6.0						
7.0	3-0	2'				
8.0						
9.0	4-0	1.0'				
10.0	5-0	.5'				

Drill Site Geologist: J.A. MEERMAN Date: 1/19/87
Reviewed By: W. [Signature] Date: 1/20/87

Borehole: E42A

Well Number: E42A 37369

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
11.0	11-12	1.0'		11-12	SM	<p><u>SM</u> silty sand, 40% silt, vfg sand, 10 gr 5/4 ywh brn, med-dense, non-plast, saturated Alluvium</p> <p>m - c. g. sand 1.5115E</p>
12.0	12-14	2.0'				
14.0	14-16	2.0'				
16.0	16-18	1.5'				
18.0	18-20	1.5'				
20.0	20-22	1.5'				
22.0						

Drill Site Geologist: D. J. McElroy

Date: 11/19/87

Borehole: E42A

Well Number: E42A 37369

SOILS LOG
Description

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
22		20'			SM	SM, silty sand, 40% silt 10gr 3/4, dk grey brn, loose, non-plast, saturated alluvium
24	55-HC	1.0'				
25		1.0' sluff				clay, silty (?) BEDROCK AT 25' END OF BORING
26						
						WELL KEENEED TO 25' FOR WELL DEPTH W/ 10" I.D. A.S. AUGER 8 1/4" I.D. Auger JLR
						WDA

WELL CONSTRUCTION SUMMARY

Borehole E44A Well 37373
Project Name and Location KMA Offsite - C10 2 Project Number 1705304510
Drilling Company Boyles Bros Driller V. Jarvis Rig Number 857
Drilling Method(s) intermittent core

Borehole Diameter 12 1/4 in. 0 ft. 26 cm. to 26 ft. 0 cm.
in. cm. ft. cm. to ft. cm.

Size(s) and types of Bit(s) 3 1/4" + 12" hollow stem auger

Size and Type PVC 1" schedule 80

Total Borehole Depth 25.7 ft. 0 cm.

Depth to Bedrock 25 ft. 0 cm.

Depth to Water 3 ft. 0 cm.

Water Level Determined By Field observation

Length Plain PVC (total) 14.94 ft. 0 cm.

Length of Screen 21.40 ft. 0 cm.

Total Length of Well Casing 28.36 ft. 0 cm.

PVC Stick Up 2.7 ft. 0 cm.

Depth to Bottom of Screen 25.7 ft. 0 cm.

Depth to Top of Screen 4.3 ft. 0 cm.

Depth to Top of Sand 3.3 ft. 0 cm.

Depth to Top of Bentonite 2.0 ft. 0 cm.

Sampling Method(s) Continuous Core

Date/Time Start Drilling 1/20/87 1038

Date/Time Finish Drilling 1/20/87 1228

Date/Time Start Completion 1/20/87 1348

Date/Time Cement Protective Casing 1/20/87 1521

Materials Used 7-4' TUBES 3 BOXES

Plain PVC 1-10'

Slotted PVC 2-10'

Bentonite Pellets 1 1/2 buckets

Bentonite Granular 10#

Cement 1 bag

Sand 13 1/2 bags

Water added during completion 3 gal

Water added during drilling 0

Total Gallons of water added 3 gal

Drill Site Geologist D.A. Mearns

Date 1/20/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 1/14/87 JWF

Date/Time/Personnel Casing Painted JWF BAG 4/15/87 1009

Date/Time/Personnel Numbers Painted JWF BAG 4/15/87 1009

Materials Used

Top of Protective Casing to Top of PVC 0.76 ft. 0 cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.4 ft. 0 cm.

Top of Protective Casing to Internal Mortar 2.4 ft. 0 cm.

Top of Protective Casing to Top of Cement Pad 2.8 ft. 0 cm.

Top of Protective Casing to Ground Level 3.5 ft. 0 cm.

Reviewed By Joseph L. Reed Date 4/20/87

Drill Site Geologist Date

Borehole: 4A

Well: 37373

Depth-Feet	Soil/Rock Type	Well Completion	Description
0			
2			Top of bentonite (2.0)
4			Top of sand (3.3)
6			Water level (3.5)
8			Top of screen (4.3) / Joint
10			
12			
14			
16			
18			
20			
22			
24			
25.7			Bottom of screen (25.7)
26			

Drill Site Geologist: P. Linda Manna Date: 4/20/87
Reviewed By: Joseph L. Reed Date: 4/20/87

Borehole: 244A

Well Number: 244A 37373

SOILS LOG						Description
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
1	0-2	2'	NA	0-2	SC	SC, clayey sand, 20% clay, 10-IR 3/1-2, v. dk gry to v. dk gry-brn, med stiff, sh plus, moist, alluvium, roots present in top 0.3'
2	2-4	1'	NA	2-4	SM	SM, silty sand, 40% silt, 10-IR 4/4-6, dk ywsh brn, med dense, non plus, moist, alluvium
3						
4	4-6	2'		4-6		At 3.0' sample is wet At 4.0' sample is sat, water level approximated @ 3.5'
5						
6	6-8	2'		6-8		
7			NA		SC	SC, clayey sand, 30% clay, 10-IR 4/4-6, dk ywsh brn, med stiff, plus sat, alluvium
8	8-10	2'	NA	8-10	SM	SM, silty sand, 30% silt, 10-IR 4/4-6, dk ywsh brn, med dense, non plus, sat, alluvium
9						
10	10-12	1/2'	NA	10-12	SW	At 10' center changing to DRAIN SW, coarse sand, few fines, 10-IR 5/4-6, ywsh brn, loose, non plus, sat, alluvium
11						

Drill Site Geologist:

D.A. McManus

Date:

1/27/57

11/10/57

Borehole: E44A

Well Number: E44A 37373

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11			NA		sw	sw as above
12	12-A	1'		12-A		
13						
14	14-B	1'		14-B		
15						
16	16-B	1/2'		16-B		At 16' sand is coarse w/ occ gravel
17						
18	18-20	0		18-20		
19						
20	20-22	1'		20-22		
21						
22						

Drill Site Geologist: D.A. Huggan

Date: 1/21/87

Reviewed By: D.A. Huggan David L. Reed

Date: 1/22/87 + 1/14/87

Borehole:

Well Number:

SOILS LOG

Description

Drill Site Geologist:

Date:

Reviewed: Re

Date

WELL CONSTRUCTION SUMMARY

Borehole E-44-081 Well 37398
Project Name and Location RMA Mountain Well Instal. Project Number T39
Drilling Company Boyle Bros Driller Tom High Rig Number Mobile B-61
Drilling Method(s) 3 1/4" ID 6 1/2" OD Hollow stem Auger with Moss sampler,
then reamed with 12 1/4" OD Hollow stem Auger with center bit
Borehole Diameter 6 1/2 in. cm. 0 ft. cm. to 24.0 ft. cm.
Reamed 12 1/4 in. cm. 0 ft. cm. to 25.0 ft. cm.

Size(s) and types of Bit(s) 3 1/2" OD + 12 1/4" OD
Auger bits

Size and Type PVC 2" sch 40 1020510t

Total Borehole Depth 25.0 ft. cm.

Depth to Bedrock 23.7 ft. cm.

Depth to Water 2.2 ft. cm.

Water Level Determined By measuring surface

Length Plain PVC (total) 6.11 ft. cm.

Length of Screen 20.29 ft. cm.

Total Length of Well Casing 26.40 ft. cm.

PVC Stick Up 2.70 ft. cm.

Depth to Bottom of Screen 23.70 ft. cm.

Depth to Top of Screen 3.41 ft. cm.

Depth to Top of Sand 2.50 ft. cm.

Depth to Top of Bentonite 1.50 ft. cm.

Sampling Method(s) Continuous - Moss System

Date/Time Start Drilling 3/22/88 1042

Date/Time Finish Drilling 3/23/88 1048

Date/Time Start Completion 3/23/88 1123

Date/Time Cement Protective Casing 3/23/88 1440

Materials Used 3/23/88 1048 SP

Plain PVC 1-10' sect. (wt)

Slotted PVC 2-10' sections 1 end cap, 1 top cap

Bentonite Pellets 1 bucket

Bentonite Granular 1/5 bag

Cement 2 bags

Sand 14 bags

Water added during completion 0

Water added during drilling 50 gal

Total Gallons of water added 50 gal

Drill Site Geologist Steve Davis

Date 4/1/88

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3/25/88 1330 BWJRR

Date/Time/Personnel Casing Painted 3/25/88 1450 BWJRR

Date/Time/Personnel Numbers Painted 3/25/88 1530 BWJRR

Materials Used 12 bags of Sukrets

Top of Protective Casing to Top of PVC 0.38 ft. cm.

COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.38 ft. cm.

Top of Protective Casing to Internal Mortar 2.40 ft. cm.

Top of Protective Casing to Top of Cement Pad 2.5 ft. cm.

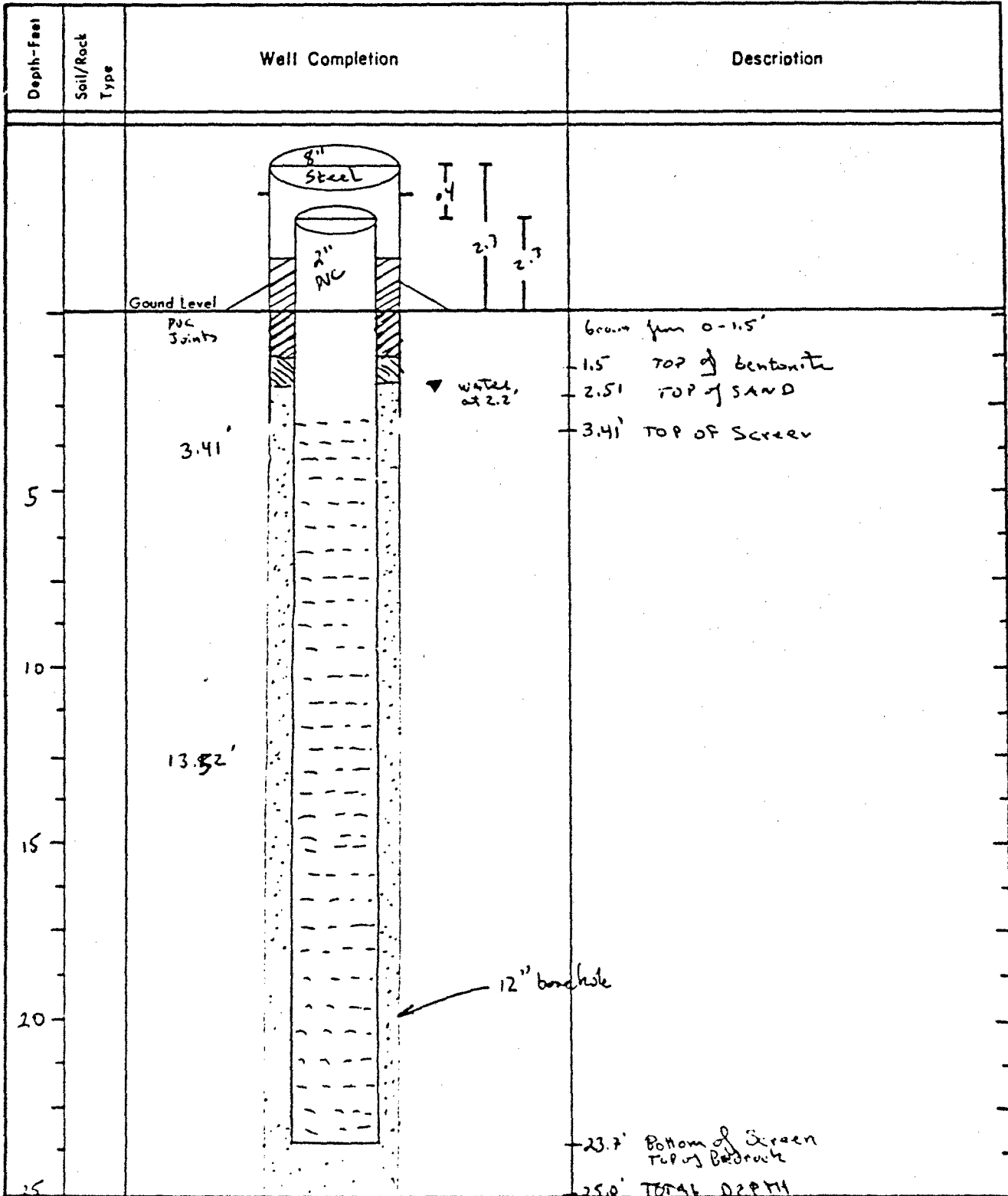
Top of Protective Casing to Ground Level 2.7 ft. cm.

Reviewed By [Signature] Date 4-8-88

Drill Site Geologist Steve Davis Date 4-8-88

Borehole: EPD E-44-081

Well: 37398



Drill Site Geologist: [Signature]
Reviewed By: [Signature]

Date: 4.1.78
Date: 4.8.88

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7322 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-3037/41-0839SHEET 1 OF 3Borehole: E-44 OB-1Well Number: OB-1 37398

SOILS LOG

Description

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
0						
1	0 1 2	4/2 2 1/2	1	0 ↓ 2	SC	Clayey sand, 35% clay 10VR 3/2 Very dark grayish brn, fine to medium sand moist, low plastic, med stiff
2	2 1 4	1.9 2.0 1.7		2 ↓ 4	SM	SM/silty sand fine to medium, 20% silt 10VR 3/3 dark brown, low plastic, soft, Very moist b-
4	4 ↓ 6	1.7 ↓ 2		4 ↓ 6		Saturated at 4' Same as above
6	6 ↓ 8	2/2		6 ↓ 8	SC	Sandy clayey sand, fine to coarse, 30% clay 2.5V/5/2.4 light olive grayish brn, med plastic Soft
8	8 ↓ 10	2/2		8 ↓ 10		From 9.5 to 10 interbedded with thin lenses of fine to medium sand

Drill Site Geologist: [Signature]Date: 4-15-88Reviewed By: [Signature]Date: 4/20/88

Borehole: E-44 03-1

Well Number: GB-1 37398

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
10	10		10	10	SP	Sand fine to medium, 4% silt, 10% R 6/8 brownish yellow, saturated, loose, non-plast.
11	11	1.5/2	11	11		
12	12		12	12		
13	13	1/2	13	13		
14	14		14	14		NO Recovery 14 feet to 19.4 feet Flowing sands
15	15	0/2	15	15		
16	16		16	16		
17	17	0/2	17	17		
18	18		18	18		
19	19	1.5/2	19	19		
20	20		20	20	SP	Sand-fine to medium 2.5% silt 5/4 light olive brown, saturated, loose

Drill Site Geologist: [Signature]

Date: 4.15.88

Reviewed By: [Signature]

Date: 4/20/88

Depth-feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
	20			20	SP	
21	↓	2/4				↓ Same as above
22	22 24					
23	↓					
23.7	24			24		23.6 Bedrock = Claystone weathered 2.5Y 6/6 olive yellow

Drill Site Geologist: [Signature] Date: 4.13.88
Reviewed By: [Signature] Date: 4/20/88

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-303741-0639PAGE 1 OF 2

WELL CONSTRUCTION SUMMARY

Borehole E-44 OB-2 Well 37399
Project Name and Location RMA OFFSET SECT. 14 Project Number TASK 39
Drilling Company BOTTLES BROS. Driller TOM HIGHT Rig Number B-61 Auger rig
Drilling Method(s) Auger w/ Moss System in 6 1/2" OD. Hollow Stem Augers, then
ream hole w/ 12" OD. auger.
Borehole Diameter 12 in. 0 cm. 0 ft. 24 cm. to 24 ft. 0 cm.
0 in. 0 cm. 0 ft. 0 cm. to 0 ft. 0 cm.
Size(s) and types of Bit(s) 6 1/2" OD. hollow stem
auger, 12" OD. auger.
Sampling Method(s) Moss System w/ hollow stem A
Date/Time Start Drilling 3-24-88 / 0940
Date/Time Finish Drilling 3-24-88 / 1324
Date/Time Start Completion 3-24-88 / 1403
Date/Time Cement Protective Casing 3-24-88 / 1500
Size and Type PVC 2" Sch. 40
Materials Used 8" Surface casing.
Total Borehole Depth 24 ft. 0 cm.
Plain PVC (1) 10 ft. section
Depth to Bedrock 22.8 ft. 0 cm.
Slotted PVC (2) 10 ft. sections
Depth to Water 2.4 ft. 0 cm.
Bentonite Pellets 1/2 bucket
Water Level Determined By Solinst water level meter.
Bentonite Granular N/A
Length Plain PVC (total) 6.42 ft. 0 cm.
Cement 2 bags.
Length of Screen 20.28 ft. 0 cm.
Sand 12 bags
Total Length of Well Casing 26.70 ft. 0 cm.
Water added during completion 0
PVC Stick Up 2.65 ft. 0 cm.
Water added during drilling 50 gal
Depth to Bottom of Screen 24.05 ft. 0 cm.
Total Gallons of water added 50 gal
Depth to Top of Screen 3.77 ft. 0 cm.
Depth to Top of Sand 2.1 ft. 0 cm.
Depth to Top of Bentonite 0.5 ft. 0 cm.

Drill Site Geologist [Signature]Date 3/25/88

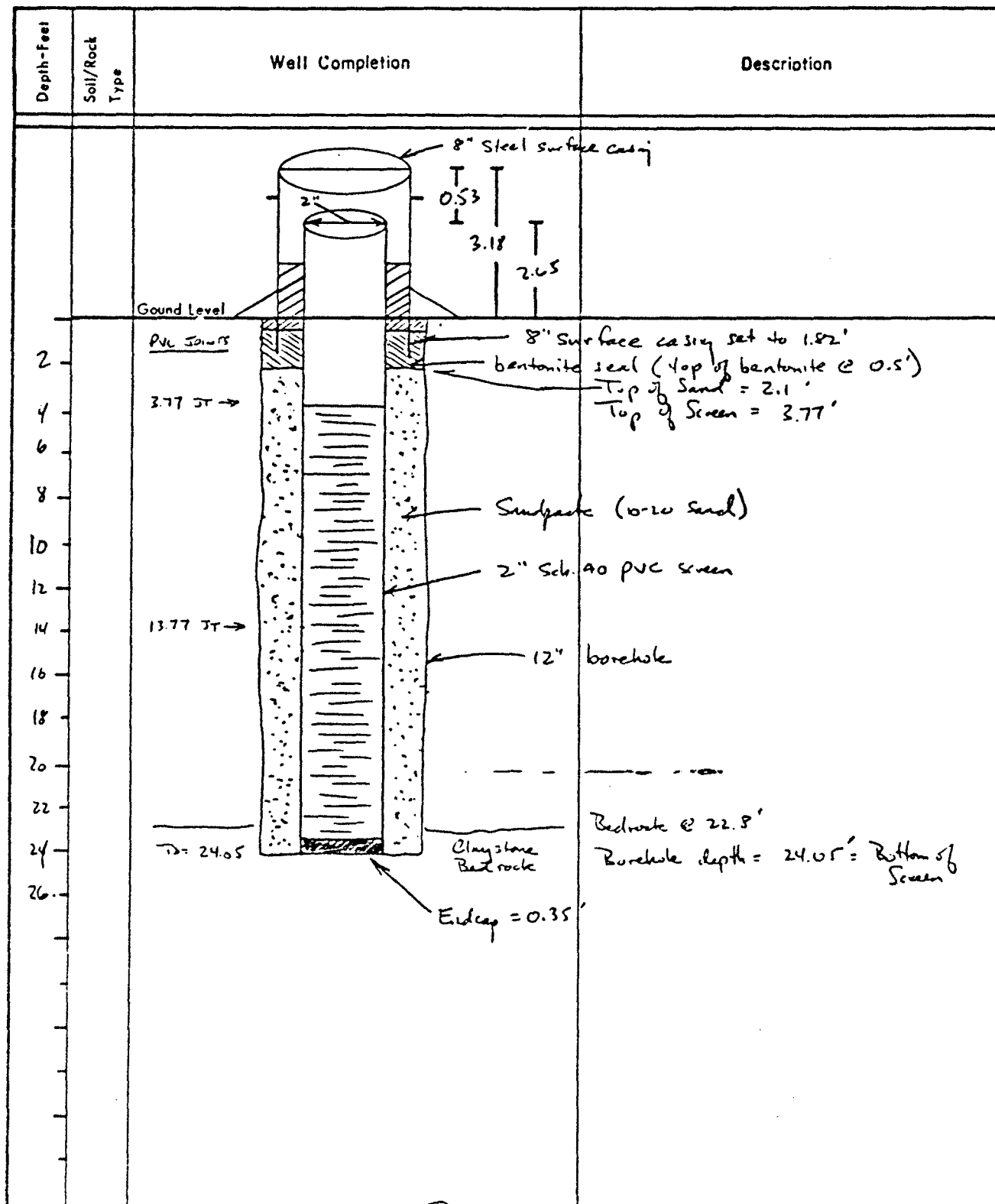
Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3/25/88 1430 BW & RR
Date/Time/Personnel Casing Painted 3/25/88 1500 BW & RR
Date/Time/Personnel Numbers Painted 3/25/88 1530 BW & RR
Materials Used 12 bags saccrete

		COMMENT/NOTES
Top of Protective Casing to Top of PVC	<u>0.53</u> ft. <u>0</u> cm.	
Top of Protective Casing to Weep Hole	<u>2.29</u> ft. <u>0</u> cm.	
Top of Protective Casing to Internal Mortar	<u>2.38</u> ft. <u>0</u> cm.	
Top of Protective Casing to Top of Cement Pad	<u>2.67</u> ft. <u>0</u> cm.	
Top of Protective Casing to Ground Level	<u>3.18</u> ft. <u>0</u> cm.	

Reviewed By [Signature]Date 3/27/88Drill Site Geologist [Signature]Date 3/25/88

Borehole: E-44 06-2

Well: 37397



Drill Site Geologist:
Reviewed By:

Date: 3/25/88
Date: 3/22/88

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY, SUITE H-1
ENGLEWOOD, COLORADO 80112-3037/41-0639SHEET 1 OF 3Borehole: E-44082Well Number: 37399

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
		1.5 2.0			SC	clay SAND, 30% clay, fine to medium grained sand, 10YR 3/3, dark brown, moist, low plastic, med stiff
2		1.6 2.0			SM	Silty SAND, 30% silt, fine to medium ^{grained} sand, 10YR 3/3 dark brown, saturated, non plastic
4		1.0 2.0			SC	clayey SAND, 25% clay, fine to medium grained sand 10YR 3/3 dark brown, saturated, low plastic
6		2.0 2.0			SC	clayey SAND, 35% clay, fine to coarse grained sand, 10YR 4/3 brown, moist, stiff, medium plastic
8						No Recovery 8' to 18' SP 20'
10						

Drill Site Geologist: [Signature]Date: 3/25/88Reviewed By: [Signature]Date: 3/27/88

Well Number:

Drill Site Geologist: AG [signature] Date: 3/25/08
Reviewed By: AG [signature] Date: 3/27/08

Reviewed By:

Borehole: E-44081

Well Number: 37399

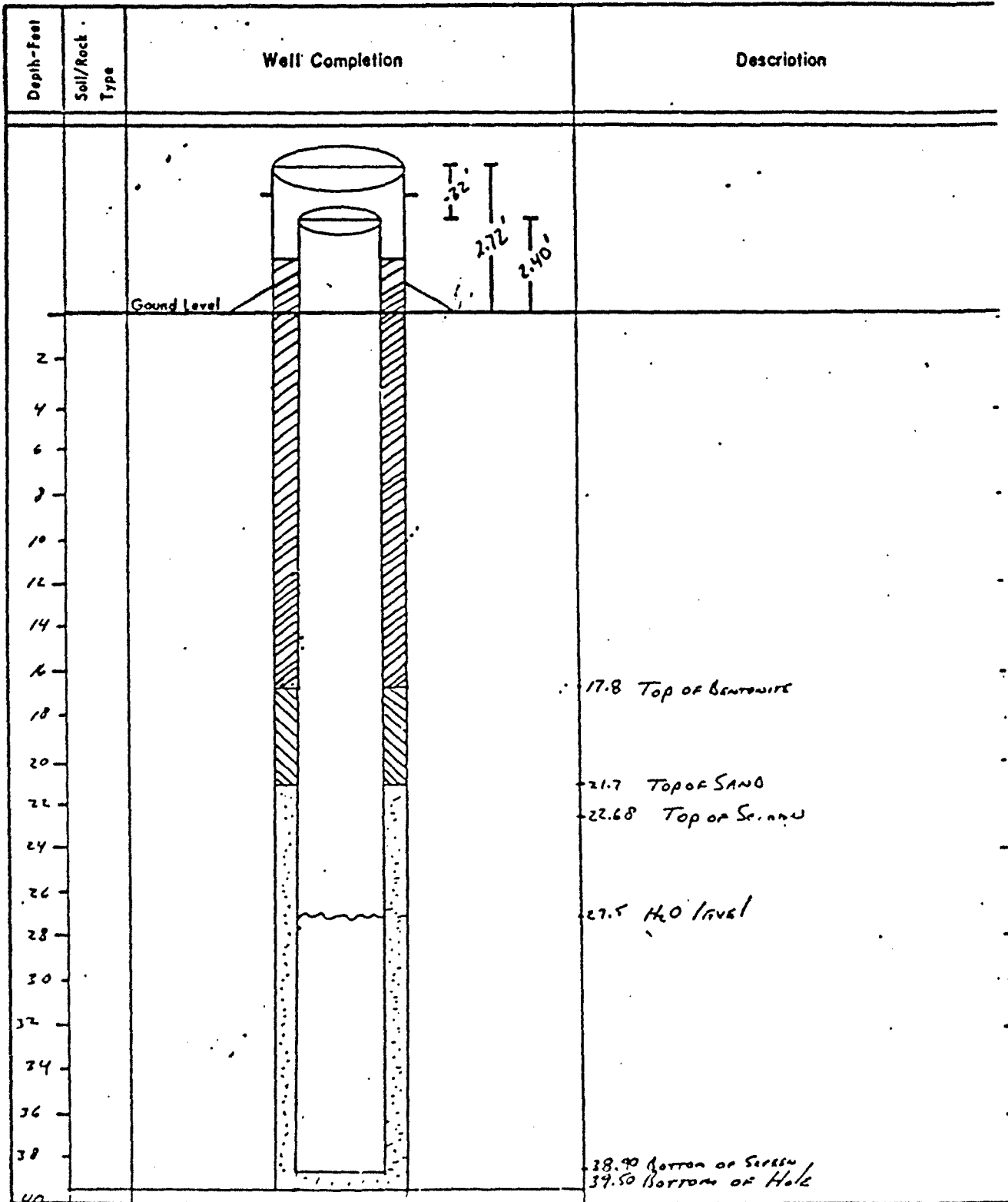
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
20					SP	SAND, 3% silt, medium to very coarse grained 10YR 6/4 brownish yellow, saturated, loose
22						
					12.8'	sandstone bedrock, fine grained, silty, 2.5Y 5/4, light olive brown, weathered.
24						TOTAL DEPTH 24.0'

Drill Site Geologist: [Signature]

Date: 3/25/88

Reviewed By: [Signature]

Date: 3/27/88

Borehole: E-46AWell: E-46A-1 37377Drill Site Geologist: Cay LHReviewed By: Joseph R. ReedDate: 3/2/87Date: 7/23/87

WELL CONSTRUCTION SUMMARY

Borehole E-46A Well E-46A 37377
Project Name and Location Task 26 Yampa N. Fork E of Panguitch Project Number 17053.074.10
Drilling Company Boyle Bros Driller DAVE JERRY Rig Number _____
Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. _____ cm. 0 ft. _____ cm. to 39.5 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) _____

Size and Type PVC 4" Screen .020

Total Borehole Depth 39.5 ft. _____ cm.

Depth to Bedrock 39.5 ft. _____ cm.

Depth to Water 27.5 ft. _____ cm.

Water Level Determined By Previous Boring

Length Plain PVC (total) 25.4 ft. _____ cm.

Length of Screen 16.23 ft. _____ cm.

Total Length of Well Casing 41.63 ft. _____ cm.

PVC Stick Up 2.7 ft. _____ cm.

Depth to Bottom of Screen 38.90 ft. _____ cm.

Depth to Top of Screen 22.68 ft. _____ cm.

Depth to Top of Sand 21.7 ft. _____ cm.

Depth to Top of Bentonite 17.8 ft. _____ cm.

Sampling Method(s) no sampling

Date/Time Start Drilling 4/21 11:30

Date/Time Finish Drilling 4/21 1400

Date/Time Start Completion 4/21 1400

Date/Time Cement Protective Casing 3/10/87 10:00

Materials Used _____

Plain PVC 3 - 10' sections

Slotted PVC 1 - 10' 1-5'

Bentonite Pellets 4 Buckets

Bentonite Granular 0

Cement 10 Bags ARAGONA 100/20 50

Sand 8 BAGS

Water added during completion 5 Gals to Seal

Water added during drilling 0

Total Gallons of water added 5.0

Drill Site Geologist Greg L. Lued

Date 3/9/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole installed 4/8/87/0930 K. Pacheco, M. Westcott

Date/Time/Personnel Casing Painted 4/9/87/11000 K. Pacheco, M. Westcott

Date/Time/Personnel Numbers Painted 4/15/87 1031 JWF BA

Materials Used 12 bags quickrete cement, 1/4 portland cement, 1/2 bag silicium sand water

Top of Protective Casing to Top of PVC 232 ft. _____ cm.

Top of Protective Casing to Weep Hole 1.5 ft. _____ cm.

Top of Protective Casing to Internal Mortar 1.19 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 2.72 ft. _____ cm.

Top of Protective Casing to Ground Level 2.72 ft. _____ cm.

COMMENT/NOTES

Reviewed By Joseph L. Reed Date 4/23/87

Drill Site Geologist _____ Date _____

Borehole: E-46AWell Number: 37377

SOILS LOG					
Description					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
0.0			NA		ML
1.0	0-2'	1'		0-2'	
2.0					
2.6	2-4'	1.6'		2-4'	
3.0					
4.0	4-5.5'	1.5'		4-5.5'	
5.0					
5.5	5.5-6.5'	1'		5.5-6.5'	
6.0					
6.5	6.5-8.5'	2'		6.5-8.5'	
7.0					
8.0					
8.5					
9.0					
10.0	8.5-12.5'	4'		8.5-13.5'	
11.0					

Munsell Colors

ML Sandy-silt, 30-35% f.g. sand, 10YR 5/2-3, greyish brn., non-pl. loose, dry, alluvium.

At 2.6' color changes to 10YR 5/3-4, brn., moisture increases to slightly moist.

At 5.0' color changes to 10YR 5/4-6, yellow brn., natural density increases to med. dense.

At 6.5' percent f.g. calc. sand increases to ~15%, color changes to 10YR, 6/4-6, light yellow brn.

Drill Site Geologist: A.E. OstbyDate: 3/12/87Reviewed By: Joseph L. ReedDate: 4/16/87

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112-3037/41-0438SHEET 2 OF 4Borehole: E-46AWell Number: 37377

SOILS LOG

Description

Munsie Creek

Depth-Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
11.0	8.5-12.5	4'	NA	8.5-13.5	ML	At 11.0', percent f.g. calc. sand decreases to 30% 40% ~ 5%.
12.0						
12.5	12.5-13.5	1'				
13.0						
13.5	13.5-17.5	3'		13.5-18'		
14.0						
15.0						
16.0					SM	SM silty-sand, ~ 30% silt, 10 YR 4/4-6, dk. ywash. brn., non-plus, loose, moist alluvium.
17.0	17-18'	1'				
18.0						
19.0	18-21'	2.2'		18-22'	ML	ML sandy-silt, ~ 15-20% f.g. sand, 10 YR, 5/3-4, brn., non-plus, loose, moist, alluvium.
20.0						
21.0	21-22'	1'				
22.0						

Drill Site Geologist: Joe DintallyDate: 3/12/87Reviewed By: Joseph L. ReesDate: 4/16/87

Borehole: E-46A

Well Number: 37377

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						<u>MUNICKEL CLAYS</u>
22.0	22 - 23.5'	1.5'	NA	22 - 23.5'	ML	
23.0						
23.5	23.5 - 27.5'	2.3'		23.5 - 26.5'		
24.0						
25.0						
26.0						
27.0	27.5 - 28.5'	1'		27.5 - 28.5'	SM	<p><u>SM</u> silty-sand, ~15-20% silt, 10 PR 6/3-4, light <u>g</u> ywsh brn, non phs, loose, wet, alluvium. <u>MPR 27.5</u> At 27.8, percent silt decreases to 2-3%, 95% coarse gr. sand, moisture increases & (saturated).</p>
27.5						
28.0	28.5 - 32.5'	1'		28.5 - 32.5'		<p>SP in SW?</p>
28.5						
29.0						<p>At 32.0 color changes to 10 YR 6/2, light brownish <u>gray</u></p>
30.0						
31.0	32.5 - 34'	0.5'		32.5 - 34'		
32.0						
32.5						
33.0						

Drill Site Geologist: John J. Fultz

Date: 3/12/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

Borehole: E46A

Well Number: _____

SOILS LOG

Description

MUNSELL COLORS

33.0

32.5-34

0.5'

NA

32.5-34

SM

34.0

At 34.0', color changes to 10YR, 6/2, light brown.
gy.

35.0

34-37

1'

34-39

36.0

37.0

37-39

0.6'

NA

At 37.0', color changes to 10YR, 5/3-4, brown.

38.0

39.0

39-42

0'

39-42

NO RECOVERY

AUGER LOSS

40.0

41.0

42.0

42-42.5

0.5'

42-42.5

At 42.5' natural density changes to v. dense, fine to med. gr. sandstone / bedrock.

42.5

43.0

END OF BORING LOG

44.0

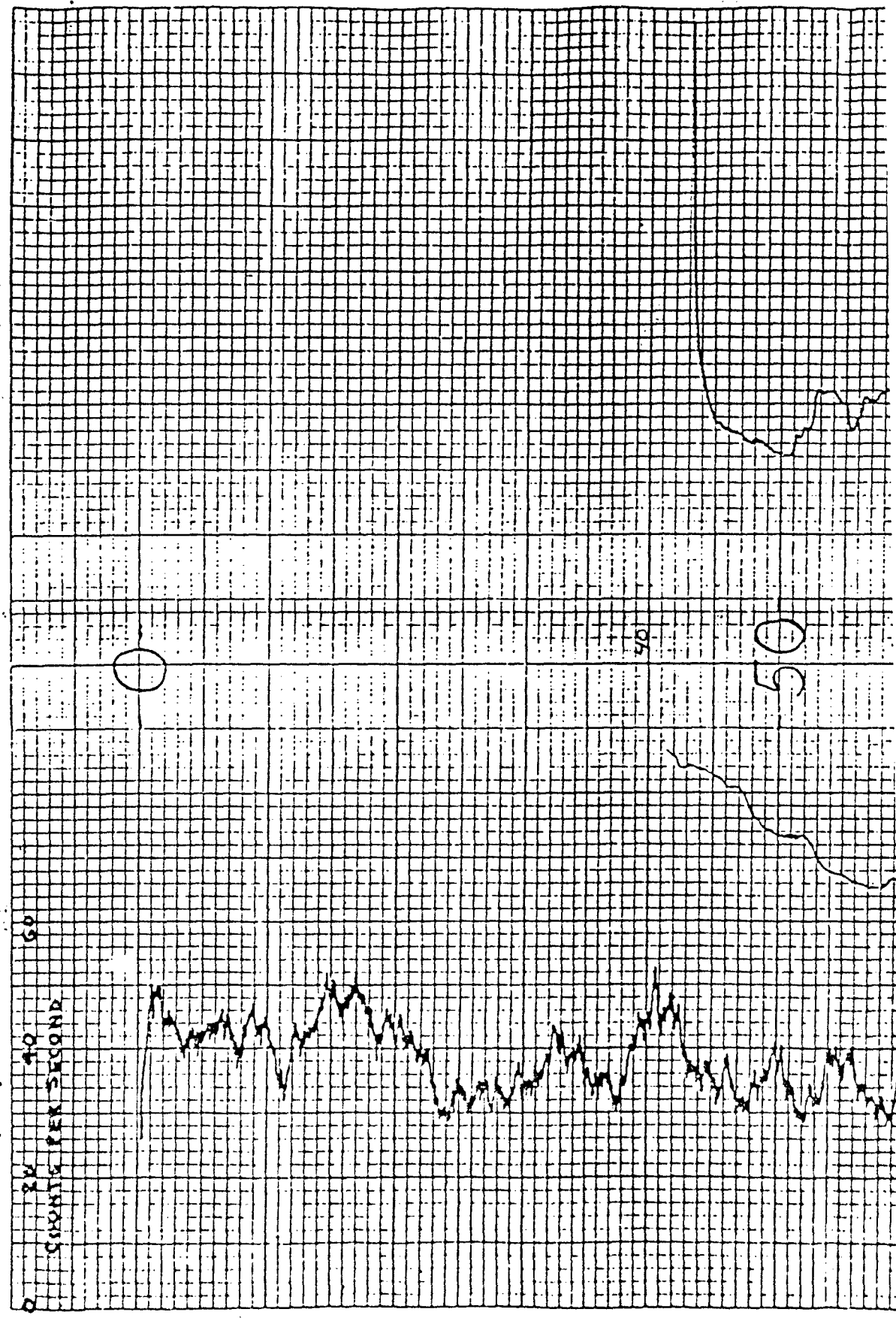
Drill Site Geologist: Bob DittellDate: 3/12/87Reviewed By: Joseph L. ReedDate: 4/16/87

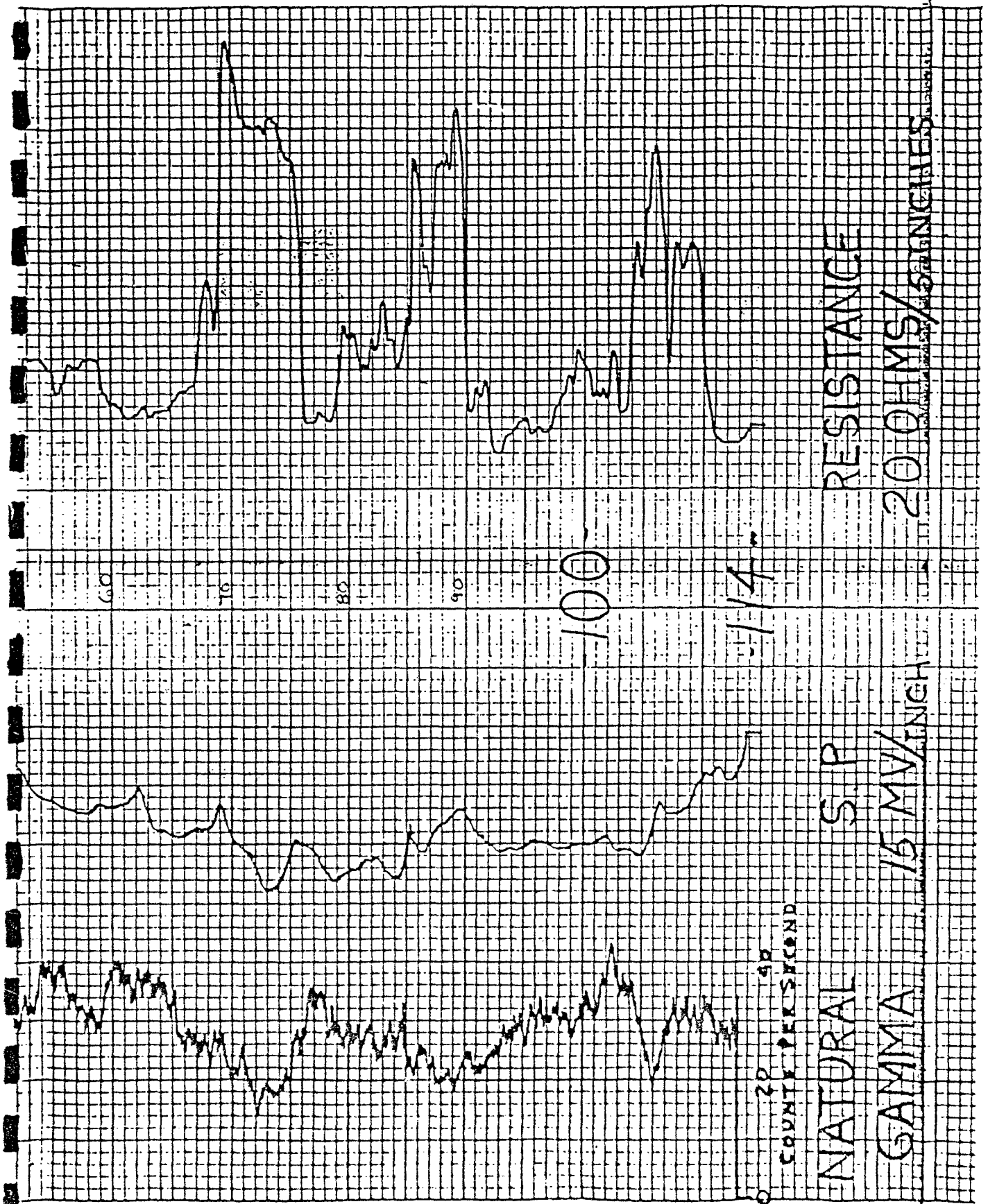
E, Inc.

(HOB) No.	Core No.	Depth ft	Lith. Class	Lith. Color	Lith. Change	Lith. Class	Description/Comments
60			CL	CLAYSTONE			
62	②						
64		5 5					
66							
68							
70	③	5 5					
72							
74		5 5					
76	④						
78		5 5					
80							
82							
84							
86							
88							
90							
92							
94							
96							
98							
100							

BOX No.	DEPTH Feet	U	S	Structure Bedding Angle	Description	Mineralogy		Color	Texture/ Grain Size classified by no. on 01 to 100	Lith. Char.	Lith. Class	Description/Comments CM (Scale 1" = 2' ft)
						Min.	Probable					
80					massive	chert 3%	siliceous m. 1/2"	gray G		sand 30%	ST	SILTY SANDSTONE SAND SILTSTONE
82								gray G		81"	SS	SILTY SANDSTONE
84	5 5 1/2									clay 20%		CLAY INTERBED
86					bedded (med. to thick)	chert 10%	siliceous bedded	gray G		clay 15%		CLAY INTERBED
88	5 5 1/2				cross bedding	chert 5%	siliceous cross bedded	gray G				Coarser sandstone than previously (med. grained) - well indurated
90	5 5 1/2				graded bedding	chert 5%	siliceous graded bedded	gray G				CLAY INTERBED
92					massive	chert 3%	siliceous massive	gray G			CL	SANDSTONE INTERBED
94	5 5 1/2					chert 3%	siliceous massive	gray G		sand 10%	ST	SANDSTONE "buff-looking"
96						chert 3%	siliceous massive	gray G		clay 20%		
98	3 3 1/2					chert 3%	siliceous massive	gray G		clay 10%		small white siltstone - larger pebbles - not "buff-looking", as above

NATURAL GAMMA
 20 05
 S.P.
 15 MV
 RESISTANCE
 20 OHMS/5 INCHES





20
COUNTS PER SECOND

NATURAL

S. P

GAMMA

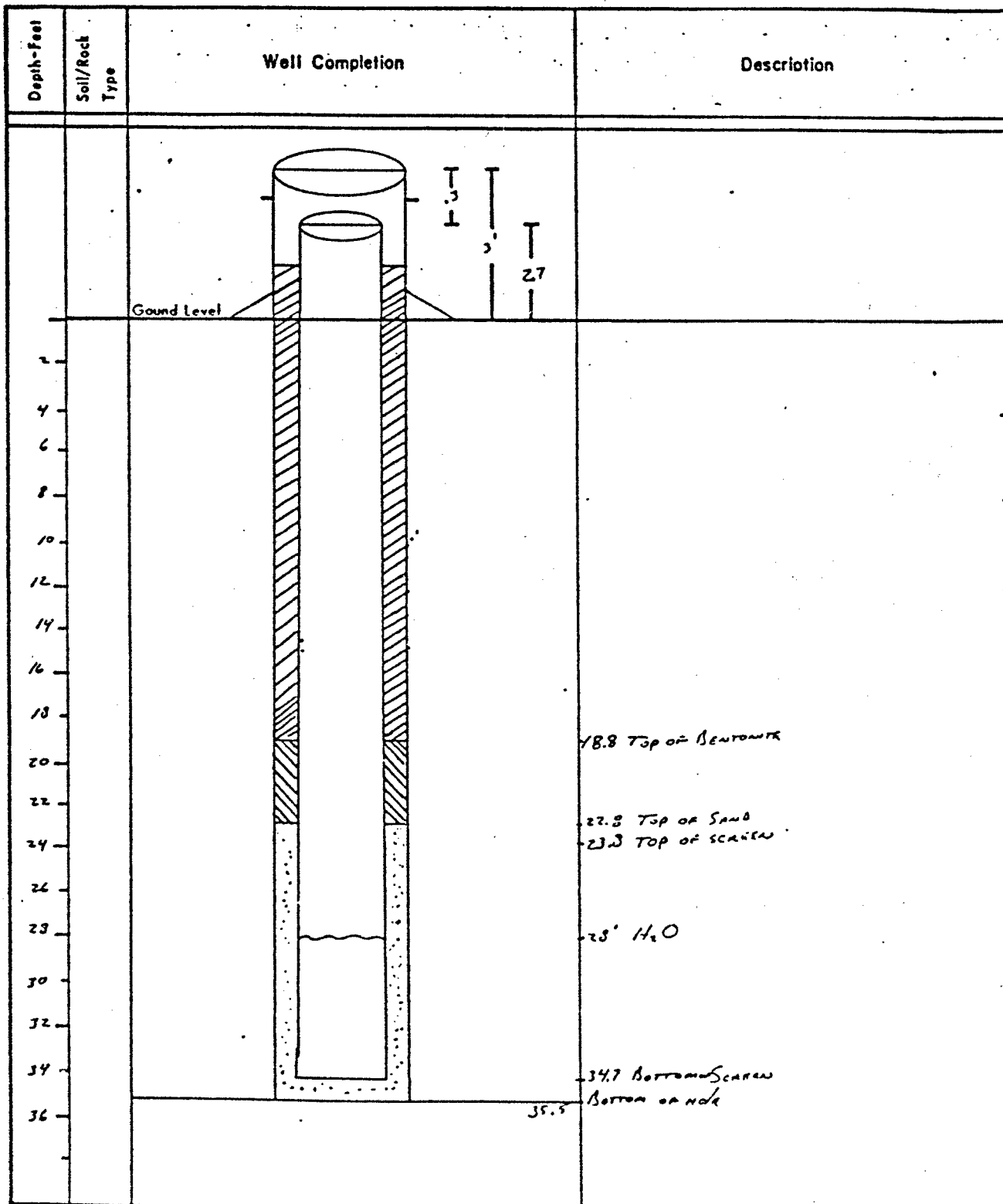
15 MV/INCH

RESISTANCE

20 OHMS/INCHES

46

LD
LD
LD

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-303741-0630PAGE 1 OF 2Borehole: E-47AWell: E-47A 37378Drill Site Geologist: Cory [Signature]Reviewed By: Joseph L. ReedDate: 3/5/87Date: 7/20/87

WELL CONSTRUCTION SUMMARY

Borehole E-47A Well E-47A 37378
 Project Name and Location 1/2 mile N, 1/2 mile E of Pkwa & 96th St Project Number 17051014.10
 Drilling Company Boyle Bros Driller DAVE JAMES Rig Number _____
 Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. _____ cm. 0 ft. _____ cm. to 25.5 ft. _____ cm.
 _____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) _____

Size and Type PVC 4" Screen .020

Total Borehole Depth 35.5 ft. _____ cm.

Depth to Bedrock 35.0 ft. _____ cm.

Depth to Water 22.0 ft. _____ cm.

Water Level Determined By Samples

Length Plain PVC (total) 26.5 ft. _____ cm.

Length of Screen 10.9 ft. _____ cm.

Total Length of Well Casing 37.4 ft. _____ cm.

PVC Stick Up 2.7 ft. _____ cm.

Depth to Bottom of Screen 34.7 ft. _____ cm.

Depth to Top of Screen 23.8 ft. _____ cm.

Depth to Top of Sand 22.8 ft. _____ cm.

Depth to Top of Bentonite 18.8 ft. _____ cm.

Sampling Method(s) CONTINUOUS Split Spoon

Date/Time Start Drilling 3/5/87 0830

Date/Time Finish Drilling 3/5/87 1400

Date/Time Start Completion 3/6/87 1400

Date/Time Cement Protective Casing 3/5/87 1600

Materials Used 9-4" TUBES 4 BOXES

Plain PVC 1-10' SECTIONS

Slotted PVC 1-10' SECTION

Bentonite Pellets 4 GUCKERS

Bentonite Granular 0

Cement 10 BAGS

Sand 25 BAGS

Water added during completion 5 GALLONS

Water added during drilling 0

Total Gallons of water added 5

Drill Site Geologist Greg L. Reed

Date 3/5/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4/8/87/1000/K. Pacheco, M. Wicks, H. 11:35 PJL

Date/Time/Personnel Casing Painted 4/9/87/1100/K. Pacheco, M. Wicks, H.

Date/Time/Personnel Numbers Painted 4/14/87 4/15/87 0945 JLF BAC

Materials Used 9 bags quickrete, 1/4 bag portland, 1/2 bag silica sand, mortar

Top of Protective Casing to Top of PVC 23.5 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 2.1 ft. _____ cm.

Top of Protective Casing to Internal Mortar 21.3 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 2.6 ft. _____ cm.

Top of Protective Casing to Ground Level 3.0 ft. _____ cm.

Reviewed By Joseph L. Reed Date 4/20/87

Drill Site Geologist _____ Date _____

Borehole: E-47A

Well Number: 37378

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
0.0			NA		ML	<p><u>ML</u> sandy-silt, 15-20% v.f. gr. sand, 10 YR, 4/1-6, dk. graysh. brn., non-plas., loose, slightly moist alluvium.</p> <p>At 2.0' color changes to 10 YR, 6/2-3, pale brn., moisture decreases to dry.</p> <p>At 4.0' color changes to 10 YR, 5/6-8, graysh. brn., moisture increases to moist, percent sand increases to ~40% v.f. gr. sand.</p> <p>At 8.0' color is mottled w/ 10 YR, 7/2-3, v. pale brn., ~30% calc. sand.</p> <p>At 10.0', percent of calc. sand decreases to 5%.</p>
1.0	0-2	2'		0-2		
2.0						
3.0	2-4	1.6'		2-4		
4.0						
5.0	4-5.5	1.2'		4-5.5		
5.5						
6.0	5.5-7.5	1.6'		5.5-7.5		
7.0						
7.5	7.5-9.5	2'		7.5-9.5		
8.0						
9.0						
9.5	9.5-11.5	2'		9.5-11.5		
10.0						
11.0						

Drill Site Geologist: A.E. J. [Signature]
Reviewed By: David L. [Signature]

Date: 3/13/87
4/17/87

Borehole: E-47A

Well Number: 37378

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						Munsell Colors
11.0	9.5-11.5	2'	NA	9.5-11.5	ML	
11.5	11.5-13.5	1.6'		11.5-13.5	SM	<u>SM</u> silty-sand, ~30% silt, 10YR, 5/6-8, yellow-brown, non-plastic, loose, moist, alluvium.
12.0						
13.0						
13.5	13.5-15.5	1'		13.5-15.5		At 14.0', percent of silt decreases to ~15%.
14.0						
15.0	15.5-17.5	1.35'		15.5-17.5		
15.5						
16.0	17.5-19.5	1.2'		17.5-19.5		At 17.0', percent of silt decreases to ~5-10%.
17.0						
17.5	19.5-21.5	1.5'		19.5-21.5	SP	<u>SP</u> Gravelly-sand, 20% quartzite gravel, 60% coarse gr. sand, 20% silt, 10YR, 5/3-4, brown, non-plastic, loose, moist, alluvium.
18.0						
19.0						
19.5						
20.0						
20.5						
21.0						
21.5						
22.0						

Drill Site Geologist: Paul D. Dettling

Reviewed By: Charles L. Reed

Date: 3/13/87

4/11/87

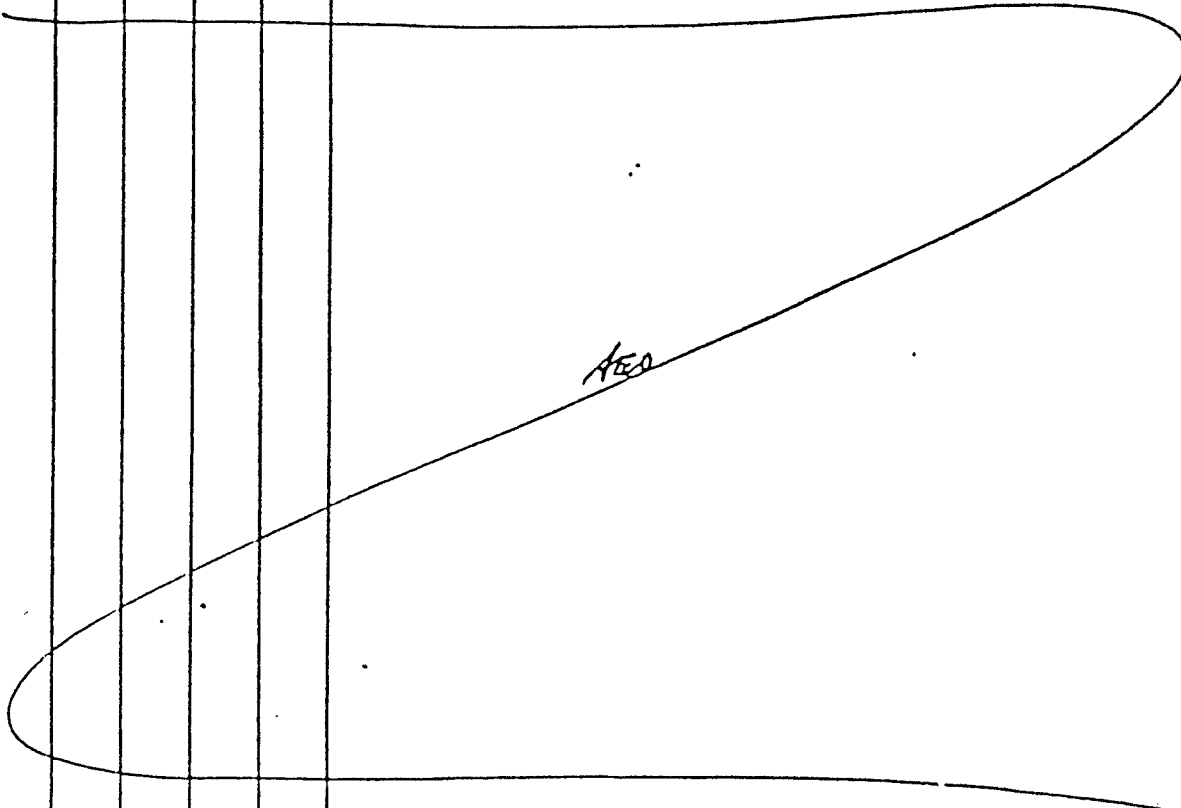
ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112-303741-0830SHEET 3 OF 4Borehole: E-47AWell Number: 37378

SOILS LOG					
Description					
Munsell Colors					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
	21.5 - 23.5	1'	NA	21.5 - 23.5	SM
	23.5 - 24	0.5'		23.5 - 24	
	24 - 25.5	1.1'		24 - 25.5	
	25.5 - 27.5	2'		25.5 - 27.5	SC
	27.5 - 29.5	1.2'		27.5 - 29.5	SM
	29.5 - 30.5	1'		29.5 - 30.5	
	30.5 - 32.5	1.3'		30.5 - 32.5	
	32.5 - 34	0'		32.5 - 34	
At 23.5' color changes to 10YR, 6/6-8 brownish yellow.					
SC Clayey-sand, ~ 30-40% clay, 10YR, 7/2-3, v. pale brn., slightly pls., soft, moist, alluvium					
WT @ 28'					
SM silty-sand, ~ 20% silt, 10YR, 5/4-6, ywash. brn., non-pls., loose, saturated alluvium					
At 31.0', percent silt decreases to 5-10%.					
No Recovery - Agree Loss					

Drill Site Geologist: Joseph L. ReedDate: 5/13/87Reviewed By: Joseph L. ReedDate: 4/16/87

Borehole: E-47A

Well Number: 37379

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						MUNSELL COLORS
33.0	32.5-34	0'		32.5-34		NO RECOVERY - AVERAGE LOSS
34.0	34-36	2'		34-36	SM ↓ CL	
34.5						
35.0						CL silty-clay, 20-30% silt, 10-15% 5/12, 5-6/1, gray w/ 5YR, 5/6 yellow red weathering, slightly plus, med. clay wet, bedrock.
36.0						END OF BORING LOG
37.0						
38.0						
39.0						
40.0						
41.0						
42.0						
43.0						
44.0						

Drill Site Geologist: Joseph L. Reed

Date: 3/13/87

Reviewed By:

Date: 9/16/87

WELL CONSTRUCTION SUMMARY

Borehole E-50 A Well 37396Project Name and Location RM 4 T39, ~1/2 mi. S. Hwy 2 of 104th Project Number 17053.075.10Drilling Company Bovis Brothers Driller D. Erickson Rig Number E.R. TH-60Drilling Method(s) Sample w/ 3 1/4" E.D. H.S. auger, 2' split sample barrel, 0.18' sample shoe, & "Moss" system. Ream w/ 8" E.D. H.S. auger w/ center bit.Borehole Diameter 12 1/2 in. 0 ft. 28.5 ft. center bit.
in. cm. ft. cm. ft. cm.Size(s) and types of Bit(s) H.S. center bit,
continuous flight augerSize and Type PVC 1" E.D. sch. 40Total Borehole Depth 28.50 ft. cm.Depth to Bedrock 28.50 ft. cm.Depth to Water 8.30 ft. cm.Water Level Determined By measurement steelLength Plain PVC (total) 9.09 ft. cm.Length of Screen 21.11 ft. cm.Total Length of Well Casing 30.20 ft. cm.PVC Stick Up 1.70 ft. cm.Depth to Bottom of Screen 28.50 ft. cm.Depth to Top of Screen 7.39 ft. cm.Depth to Top of Sand 3.40 ft. cm.Depth to Top of Bentonite 1.50 ft. cm.Sampling Method(s) 3 1/2" E.D. H.S. auger o/aDate/Time Start Drilling 12/18/87 0952Date/Time Finish Drilling 12/22/87 0935Date/Time Start Completion 12/22/87 0940Date/Time Cement Protective Casing 12/22/87 1140Materials Used 9.09' 1" sch. 40 locking casingPlain PVC 9.09' sch. 40Slotted PVC 21.11' 20 Johnson Enviro. screenBentonite Pellets 2 buckets (50#/bucket) 3/8" slopeBentonite Granular noneCement 1 bag (94#) type # MountainSand 15 1/2 bags CSSI 10-20Water added during completion 25 galWater added during drilling 0Total Gallons of water added 25 galDrill Site Geologist James F. FranceDate 1/6/88Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3-14-88 / 1335 / Dm & BWDate/Time/Personnel Casing Painted 3-10-83 TR/JGDate/Time/Personnel Numbers Painted 3-14-88 / 1335 / Dm & BWMaterials Used 10 bag substrateTop of Protective Casing to Top of PVC 0.30 ft. cm.Top of Protective Casing to Weep Hole 0.62 ft. cm.Top of Protective Casing to Internal Mortar 0.70 ft. cm.Top of Protective Casing to Top of Cement Pad 1.68 ft. cm.Top of Protective Casing to Ground Level 1.70 ft. cm.

COMMENT/NOTES

Reviewed By James F. France Date 3/15/88

Drill Site Geologist _____ Date _____

Well: 37396

Drill Site Geologist: V. L. Pearce
Reviewed By: John Doe

Date: 1/6/58
Date: 11/7/88

Borehole: E-50

Well Number: 37396

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						Munsell Colors
0					SM	Silty sand, 10-30% silt, predom. f-vf grained sand, trace clay, 10YR 3/2 v dk grayish brn, rounded-subrounded, pred qtz, abundant root fragments & organic debris, loose, non-plas, moist alluvium.
1	0-2	2'		2-2		
2						
2						
3	2-4	2'		2-4		At 3.0'; root frags absent.
4					CL	
4						At 3.8'; clay, silty clay, 10-30% silt, 10YR 4/2 dk grayish brn, slightly plas, soft, moist alluvium.
5	4-6	2'		4-6		
6						

Drill Site Geologist: [Signature]

Date: 1/6/88

Reviewed By: [Signature]

Date: 1/7/88

Borehole: E-50

Well Number: 3739b

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
Munsell Colors					
0		X			No Recovery
7	8-9	1.5	8-9		At 6.5'; <u>saturated</u> .
8		X			No Recovery
9	9-10	2	9-10		SC At 8.7'; <u>clayey sand</u> , 70-40% clay, pred f. of grained sand, occ med grnd, 10YR 4/2 dk gray br x sl. plas, soft, saturated, alluvium,
10		X			CL At 9.5'; <u>silty clay</u> , 10-30% silt, 10YR 4/1 dk gray, sl plas, soft-med stiff, moist alluvium.
11	10-11	2	10-11		
12					

Drill Site Geologist: G. F. Pearce

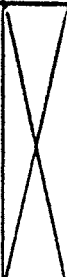
Date: 1/6/88

Reviewed By: [Signature]

Date: 1/8/88

Borehole: E-50

Well Number: 37396

SOILS LOG					
Description					
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
Munsell Colors					
12	12-14			12-14	
13					
14	14-16	0.5'		14-16	SL At 13.5'; <u>clayey sand</u> , 20-30% clay, pred f-vf grained sand, 10YR 9/1 dk gray, sl plus, saturated alluvium. At 14.0'; color changes to 40YR 5/3 not brn some Fe stain 10YR 6/8 brn yell.
15		2'			
16	16-18	2'		16-18	SM At 15.0'; <u>silty sand</u> , 10-30% silt, pred. f grained sand, 10-20% clay, 10YR 5/3 brn, w/ mottled and occ layered Fe stain 10YR 5/8 yell brn, pred glt, sme ferromags, sl plus, saturated, alluvium.
17					SC At 15.8'; <u>clayey sand</u> , 25-30% clay, pred f-vf w/ occ med grained sand, 10-20% silt, 10YR 5/4 yell brn, w/ mottled Fe stain as above, sl plus, soft, saturated, alluv.
18					CL At 17.2, <u>silty clay</u> , 20-30% silt, some v-f sand, 10YR 5/3 brn, Fe stain absent, sl-low plus, soft-med stiff, saturated, alluvium.

Drill Site Geologist: C. F. Pearce

Date: 1/6/88

Reviewed By: AW

Date: 1/8/88

Borehole: E-50

Well Number: 37396

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						Munsell Colors
18						
19	18-20			02-81		No Recovery
20		1'			SM	At 19.0'; <u>silty sand</u> 30-40% silt, pred f grained sand, 10YR 5/4 yell brn, loose, non-pls, saturated alluvium
21	20-22	2'		20-22	SP	At 19.9'; <u>poorly graded sand</u> , 20% med, 60% fine, remainder vt w/ tr coarse, 10YR 4/4 dk yell brn, pred qtz w/ 10-20% feldspar; minor ferromags, loose, non-pls saturated alluvium. At 20.6'; 20% vt, 20% f, 20% coarse 40% med grained, color changes to 10YR 4/2 dk grayish brn.
22						At 21.7'; coarse increases to 30%
23	22-24			22-24		No Recovery
24		1'				At 23.0'; pred f grained w/ 20% med, 10% coarse, occ. pebble
						At 23.8'; pred coarse w/ abund. v. coarse

Drill Site Geologist:

J. F. Pearce

Date:

1/6/88

Reviewed By:

H. D.

Date:

1/8/88

Borehole: E-50

Well Number: 37396

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						<i>Munsell Colors.</i>
24						
25	24-26	2		24-26		
26						
27	26-28	2		26-28		At 27.0'; pred v. coarse
28						
28						At 28.3'; gravel - pebble
28						At 28.5'; weathered clay, sandy.
29	28-30	2		28-30		
29					CL	At 29.0'; clay, 10YR 4/1 dk gray, stiff, mod plas, moist, bedrock.
30						

END OF BORING LOG

Drill Site Geologist: J. Pearce

Date: 1/6/88

Reviewed By: AKS

Date: 1/8/88

WELL CONSTRUCTION SUMMARY

Borehole C-52Well 37397Project Name and Location RMT T32, 1/8 mi N. of 101st on Pavia Project Number 17053.075-10Drilling Company Boyles Brothers Driller D. Ervin Rig Number ER TH-60Drilling Method(s) Sample w/ 3 1/4" I.D. H.S. auger, 2' split sample barrel, w/ 0.18" sample shoe, and "Moss" system. Acc w/ 8" I.D. H.S. auger w/ 1 cm bitBorehole Diameter 12 1/2 in. 0 ft. 34.80 ft. cm.
in. cm. ft. cm. ft. cm.Size(s) and types of Bit(s) H.S. auger center bit, continuous flight auger.Size and Type PVC 4" I.D. sch. 40Total Borehole Depth 34.80 ft. cm.Depth to Bedrock 31.90 ft. cm.Depth to Water 25.00 ft. cm.Water Level Determined By meas. w/ steel tapeLength Plain PVC (total) 20.29 ft. cm.Length of Screen 16.17 ft. cm.Total Length of Well Casing 36.46 ft. cm.PVC Stick Up 1.70 ft. cm.Depth to Bottom of Screen 34.80 ft. cm.Depth to Top of Screen 18.63 ft. cm.Depth to Top of Sand 14.20 ft. cm.Depth to Top of Bentonite 9.00 ft. cm.Drill Site Geologist James F. PearceSampling Method(s) 3 1/4" I.D. H.S. as above.Date/Time Start Drilling 1/4/88 1420Date/Time Finish Drilling 1/5/88 1230Date/Time Start Completion 1/5/88 1230Date/Time Cement Protective Casing 1/5/88 1410Materials Used Protective casing w/ locking cap.Plain PVC 20.29' 4" I.D. sch 40Slotted PVC 16.17' 4" I.D. 20-Johnson ErvinBentonite Pellets 5 buckets (55 lb/buck) 3/8" slopeBentonite Granular noneCement 5 bags Type II MountainSand 12 bags CSSI 10-20Water added during completion 5 galWater added during drilling 0Total Gallons of water added 5 galDate 1/6/88Weep hole: 3-14-88 / 1400 / DW & BWDate/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3-10-88 / 1100 / RP & FBDate/Time/Personnel Casing Painted 3-10-88 / 1030 / RP & FBDate/Time/Personnel Numbers Painted 3-14-88 / 1400 / DW & BWMaterials Used 12 bags concreteTop of Protective Casing to Top of PVC 0.27 ft. cm.Top of Protective Casing to Weep Hole 1.57 ft. cm.Top of Protective Casing to Internal Mortar 1.60 ft. cm.Top of Protective Casing to Top of Cement Pad 1.87 ft. cm.Top of Protective Casing to Ground Level 1.87 ft. cm.Reviewed By Steve Pearce

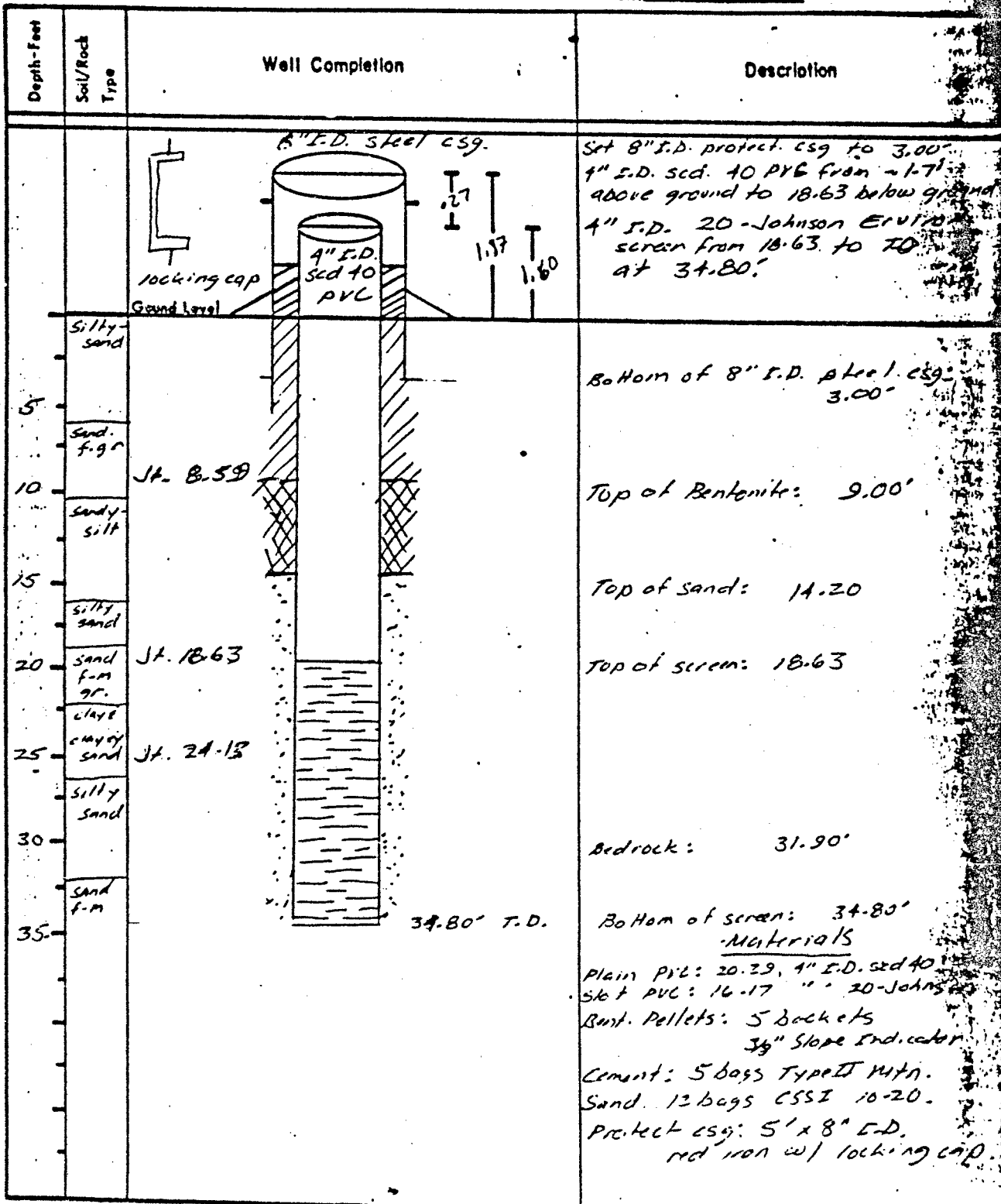
Drill Site Geologist

Date 3/15/88

Date

Date

Date

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7333 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-3037/41-0430PAGE 2 OF 2Borehole: E-52Well: 37397Drill Site Geologist: Danny F. PoirerDate: 1/6/88Reviewed By: John DoeDate: 3/15/88

Borehole: E-52

Well Number: 37397

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
0					SM	<u>Silty sand</u> , 10-20% silt, pred f grain w/ 20-30% v.f. grnd sand, subrnded to rounded qtz., 10YR 3/2 v. dk grayish brn, loose, non plas., moist alluvium.
1	2-0	2'	2-0	2-0		↓ At 1.8'; color changes to 10YR 5/4 yell. brn.
2						At 2.0'; silt increases to 20-30%, sand grain sizes change to pred rf w/ 10-20% f, ocl. med-coarse grnd sand. 10YR 4/4 dk. yell brn
3	4-2	2'	4-2	4-2		At 2.6'; no. Hld 10YR 6/4 lt. yell. brn. At 3.2'; no. Hld 10YR 6/4, absent.
4						
5	9-4	2'	9-4	9-4		
6					SP	At 5.8'; <u>poorly graded sand</u> , 20% rf., 20% red

Drill Site Geologist: James F. Pearce

Date: 1/6/88

Reviewed By: Steve Pearce

Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
7	8-9	2'	8-9	8-9		60% f grained sand, 10YE 6/6 brnsh yell. subrded to rded, gtz., 10xc, non-plas, moist alluvium. At 6.5; pred med grained sand.
8					SM	At 7.3; <u>Silly sand</u> , 10-30% silt, 20% med, 20% v.f., 20% f grned sand, 10YR 4/6 dk yell brn, subrd - rnd, gtz, loose, non-plas, moist alluvium.
9	10-8	2'	10-8	10-8		At 8.5; mottled CaCO ₃ , 10YR 6/3, pale brn
						At 9.2; 0.1' thick layer w/ 40-50% silt and moderate clay.
						At 9.5; silt decreases to 20-30%, clay abant. 20% v.f. grned, 40% fine grned sand.
10						
11	21-01	2'	21-01	21-01	ML	At 10.6; <u>Sandy silt</u> , 20-30% sand, pred v.f. f grained, occ coarse & pebble grains, 10YR 5/4, yell brn, loose, non plas, moist alluvium.
						At 11.5; sand decreases to 10-20%
12						

Drill Site Geologist: G.F. Pierce

Date: 1/6/88

Reviewed By: John Harris

Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
12						At 12.0'; sand pred. coarse grained, occ granite pebbles.
13	12-14	2	12-14	12-14		At 13.0'; color changes to 10YR 6/4, 11 yell 1. brn.
14						At 14.0'; mottled colors 10YR 7/2 11 gray sand pred f-vt grained w/ occ coarse
15	14-16	2	14-16	14-16		
16					SM	At 15.8'; silty sand, 20-30% silt, 20% vf, 20% f grained, 30% med grained,
17	16-18	2	16-18	16-18		At 16.6'; silt decreases to 10-20%, sand pred med grnd. At 17.0'; silt increases to 20-30%.
18						At 17.7'; silt decreases to 10-20%, sand pred med grained w/ 10-20% coarse grained.

Drill Site Geologist: J. A. Pearce

Date: 1/6/88

Reviewed By: Steve Rans

Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
18		X				No Recovery
19	02 - 81	1.5'	02 - 81	02 - 80	SP	At 18.5'; <u>poorly graded sand</u> , 10-20% v-f, 30% f, 30% med grained, 10YR 5/4 yell brn, subnd - rnd, gtz w/ minor feldspar, loose, non plas, moist alluvium. At 19.5'; pred coarse grained.
20					CL	At 19.7'; <u>silty clay</u> , 10-30% silt, 10YR 5/6, yell brn, sl plas, med stiff, moist, alluvium.
21	22 - 20	2'	20 - 22	20 - 22	SP	At 20.2'; <u>poorly graded sand</u> , pred coarse-med grained, 20-30% v-f-l grained, 10YR 6/4 lt yell brn, pred. rndd, gtz, loose, non-plas, moist, alluvium.
22		X			CL	At 21.8'; <u>clay</u> , trace silt, 10YR 5/2 grayish brn, low plas, stiff, moist, alluvium.
23	22 - 24	1'	22 - 24	22 - 24		No Recovery
24					SC	At 23.3'; <u>clay + sand</u> , 10-40% clay, pred med-f grained sand, 10YR 5/3, brn, w/ abundant Fe staining 5YR 4/4 red brn, subnd - rndd, gtz - feldspar, loose, non-plas, moist alluvium.

Drill Site Geologist: J. F. Ponce

Date: 1/6/88

Reviewed By: [Signature]

Date: 1/7/88

Borehole: E-52

Well Number: 37397

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
24						
25	24-26	2'	24-26	24-26		At 24.8'; o/c mottled CaCO ₃ 10YR 7/2 lt gray ↓ At 25.7'; 0.15" thick clay lens. ↓ At 26.0'; pred v.f. graind, 20% med graind. <u>saturated at 26.0'</u> ↓ At 26.4'; Fe stain & CaCO ₃ absent SM At 26.5'; silty sand, 10-30% silt, pred. f. v.f. graind sand, 10YR 5/4 yell. brn., loose, non-plas, saturated alluvium.
26						
27	26-28	2'	26-28	26-28		
28						
29	28-30	2' no sample	28-30	28-30		No Recovery
30						

Drill Site Geologist: G.F. Pearce

Date: 1/6/88

Reviewed By: [Signature]

Date: 1/7/88

Borehole: E-52

Well Number: 37397

SOILS LOG Description					
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
					Munsell colors
30					
31	30-32	X	30-32	30-32	SM
		1'			
32					SP
	32-34		32-31	32-34	
33		2'			
34					
End of Boring Log.					

At 31.2'; silty sand as above.

At 31.9'; poorly graded sand, 20% vf, 30-50% f. med, trace coarse, some silty, 10YR 4/6, dk yell. brn, med qtz, w/ abundant, Fe staining. 10YR 6/8 brn yell, med qtz, ^{thinly bedded} compacted & indurated, hard, moist bedrock.

9-7-11

Drill Site Geologist: J.F. Pearce

Date: 1/6/88

Reviewed By: [Signature]

Date: 1/7/88

WELL CONSTRUCTION SUMMARY

Borehole E-53A Well 37367
Project Name and Location RMA off Post task 39 Project Number 86-942-0210
Drilling Company Boyles Bros. Driller Dave Jarvie Rig Number 5451
Drilling Method(s) Hollow stem auger 3 1/2" ID 6 1/2" O.D. Continuous Sampling
Reamed with 8 1/2" ID 12 1/2" O.D. Hollow Stem Auger

Borehole Diameter 12 1/2 in. _____ cm. 0 ft. _____ cm. to 39.5 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) Hollow Stem Auger 12 1/2"

Sampling Method(s) Continuous Hollow Stem Auger

Size and Type PVC 4" sch 40 0.20" slot

Date/Time Start Drilling 12/17/86 1900

Total Borehole Depth 39.5 ft. _____ cm.

Date/Time Finish Drilling 12/18/86 1500

Depth to Bedrock 39.5 ft. _____ cm.

Date/Time Start Completion 12/19/86 0800

Depth to Water 87 ft. _____ cm.

Date/Time Cement Protective Casing 1000

Water Level Determined By Measurement 6 1/2" Auger After 24 hrs

Materials Used _____

Length Plain PVC (total) 13.16 ft. _____ cm.

Plain PVC 2-10'

Length of Screen 26.91 ft. _____ cm.

Slotted PVC 2-10' 1-5'

Total Length of Well Casing 40.07 ft. _____ cm.

Bentonite Pellets 5 Buckets (50 lbs)

PVC Stick Up 1.70 ft. _____ cm.

Bentonite Granular 10 lbs

Depth to Bottom of Screen 38.37 ft. _____ cm.

Cement 2 Bags

Depth to Top of Screen 11.46 ft. _____ cm.

Sand 17 Bags

Depth to Top of Sand 7.70 ft. _____ cm.

Water added during completion 10 gal

Depth to Top of Bentonite 3.70 ft. _____ cm.

Water added during drilling 0

Total Gallons of water added 10 gal

Drill Site Geologist Joe Reed

Date 12/19/86

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed _____

Date/Time/Personnel Casing Painted _____

Date/Time/Personnel Numbers Painted _____

Materials Used _____

Top of Protective Casing to Top of PVC	<u>0.35</u> ft. _____ cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>1.0</u> ft. _____ cm.	
Top of Protective Casing to Internal Mortar	<u>1.33</u> ft. _____ cm.	
Top of Protective Casing to Top of Cement Pad	<u>1.95</u> ft. _____ cm.	
Top of Protective Casing to Ground Level	<u>2.05</u> ft. _____ cm.	

Reviewed By _____ Date _____

Drill Site Geologist Joseph L. Reed Date 12/19/86

Borehole: E-53A

Well: 37367

Depth-feet	Soil/Rock Type	Well Completion	Description
5			1.41 Joint
			3.7 Top of Bentonite
10			7.70 Top of sand
			11.46 Top of Screen
20			18.7 water level
			21.98 Joint
30			32.5 joint
			38.37 Bottom of screen
40			39.5 Borehole T.D. Bedrock

Drill Site Geologist: Joseph L. Bieri
Reviewed By: _____

Date: 12/19/86
Date: _____

Borehole: E-53A

Well Number: 37367

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0 ↓ 20.0		NO RECOVERY				NO RECOVERY
20.0		82%	E53-A	20-21	ML	ML, sandy silt, 30% mgsand, 10% 4/4-6 dk. y. wash DM non-plast, med-stiff, saturated alluvium
21.0						
22.0		78%	E53-A	22-24		
23.0						
24.0			E53A	24-25		
25.0						

Drill Site Geologist: W. C. [Signature]

Date: 12/22/86

Reviewed By: _____

Date: _____

ESE ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-303741-0639

SHEET 2 OF 4

Borehole: E53A

Well Number: 37367

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
25.0		100%	E53A	25.0 - 26.5	SM	SM, silty sand, 20% silt, 11-c. grain sand, 104K 5/4 gush ben, non-plast, loose, saturated alluvium. Decrease sand size, T-gr.
26.0						
26.5		100%	E53A	26.5 - 28.0		
27.0						
28.0		100%	E53A	28.0 - 29.5		
29.0						
29.5		100%	E53A	29.5 - 31.5		
30.0						
31.0						

Drill Site Geologist: W. Gmstead

Date: 10/22/86

Borehole: E53A

Well Number: 37367

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
31.0		100%	E53A	31.0 - 32.5	SM
31.5		100%	E53A		
32.0					
32.5		100%	E53A	32.5 - 33.5	
33.0					
33.5		80% 1.5'	E53A	33.5 - 35.0	
34.0					
35.0		1.5	E53A	35.0 - 36.5	
36.0					
36.5		1.5	E53A	36.5 - 38.0	
37.0					

INCREASE grain size to COARSE
Increase grain size to coarse

DECREASE grain size to fine-med grain,
color change to 10YR 9/4-6 DRK gray BRN.

INCREASE grain size to COARSE grain

COARSE sand w/ 10% GRAVEL
SP PRG 8/28

Drill Site Geologist: W. G. [Signature]

Date: 12/22/86

Well Number: 37367

Drill Site Geologist: W. J. Mitchell Date: 12/22/86
Reviewed By: _____ Date: _____

WELL CONSTRUCTION SUMMARY

Borehole E-5308-1 Well 37400
Project Name and Location RMA off post box 12 Project Number 739
Drilling Company Boule Bros Driller Tom High Rig Number Mobile
Drilling Method(s) 3 1/4" ID Hollow stem auger Moss system sampling then
sealed with 1 1/4" OD Hollow stem auger
Borehole Diameter 1 1/4 in. 0 cm. 0 ft. 42.0 ft. 0 cm.
1 in. 1 cm. 1 ft. 1 ft. 1 cm.

Size(s) and types of Bit(s) Auger

Size and Type PVC 2" sch 40 020 slot

Total Borehole Depth 42.0 ft. 0 cm.

Depth to Bedrock 38.5 ft. 0 cm.

Depth to Water 20.0 ft. 0 cm.

Water Level Determined By sample

Length Plain PVC (total) 18.29 ft. 0 cm.

Length of Screen 25.41 ft. 0 cm.

Total Length of Well Casing 43.7 ft. 0 cm.

PVC Stick Up 2.0 ft. 0 cm.

Depth to Bottom of Screen 41.7 ft. 0 cm.

Depth to Top of Screen 16.29 ft. 0 cm.

Depth to Top of Sand 11.90 ft. 0 cm.

Depth to Top of Bentonite 7.50 ft. 0 cm.

Sampling Method(s) continuous (moss)

Date/Time Start Drilling 3/30/88 0903

Date/Time Finish Drilling 4/4/88 0958

Date/Time Start Completion 4/4/88 1028

Date/Time Cement Protective Casing 4/4/88 1210

Materials Used 1 protective casing, 1 cap, 1 bch

Plain PVC 1-10' 1-cut section

Slotted PVC 2-10' 1-5' section

Bentonite Pellets 4-buckets (50# balot)

Bentonite Granular 3/10 bags (50#)

Cement 3 bags

Sand 22 bags

Water added during completion 100 gal

Water added during drilling —

Total Gallons of water added 100 gal

Drill Site Geologist John Gorb

Date 4/14/88

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4/7/88 smf pscs 1000

Date/Time/Personnel Casing Painted 4/7/88 smf pscs 1200

Date/Time/Personnel Numbers Painted 4/8/88 smf pscs 1000

Materials Used 10 bags of sch 40

Top of Protective Casing to Top of PVC 0.24 ft. 0 cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.44 ft. 0 cm.

Top of Protective Casing to Internal Mortar 1.44 ft. 0 cm.

Top of Protective Casing to Top of Cement Pad 1.90 ft. 0 cm.

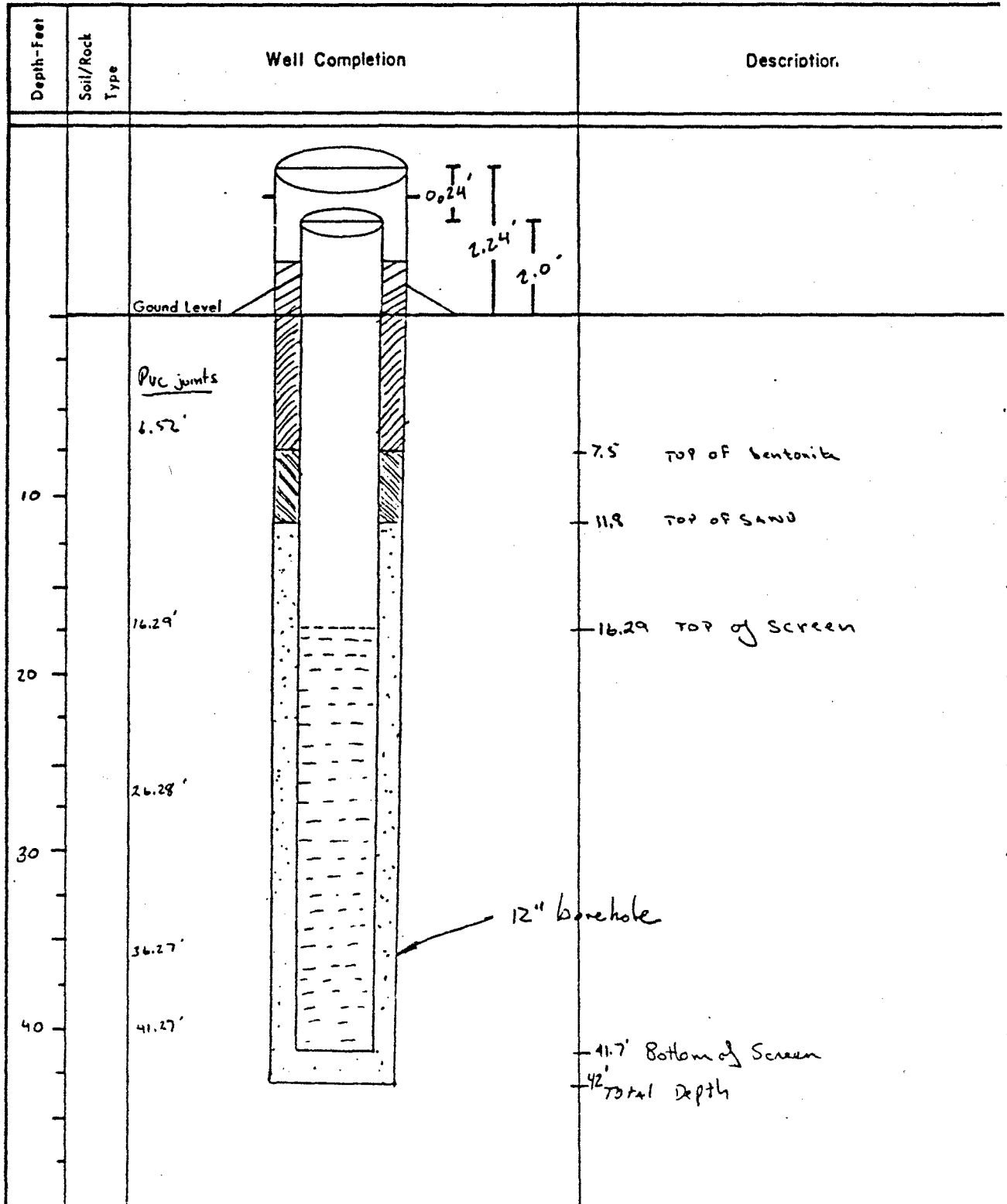
Top of Protective Casing to Ground Level 2.24 ft. 0 cm.

Reviewed By John Gorb Date 4-20-88

Drill Site Geologist John Gorb Date 4-20-88 135

Borehole: E-5308-R1

Well: 37400



Drill Site Geologist: A. P. [Signature]
Reviewed By: [Signature]

Date: 4/8/88
Date: 4-20-88

Borehole: E-53

Well Number: OB-1

37406

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
1	0 ↓ 2	2 ↓ 2	1	0 ↓ 2	SM	Silty sand, fine grained, 45% silt, 15 YR 4/4 dark yellow brown, dry, low plastic med stiff
2	2 ↓ 4	2 ↓ 2	2	2 ↓ 4	SC	Clayey sand fine to medium 25% clay 10 YR 4/4 dark yellowish brown, med stiff moist med plas
3	4 ↓ 6	2 ↓ 2	3	4 ↓ 6	SM	Silty sand, fine to medium grained, 30% silt 10 YR 5/3 brown, non cohesive, dry
4	6 ↓ 8	2 ↓ 2	4	6 ↓ 8	SC	Clayey sand, fine to medium grain, 30% clay 10 YR 6/4 light yellowish brown, med stiff moist med plastic
5	8 ↓ 9					at 8' changes to fine to coarse
6	9 ↓ 10	2 ↓ 2	5	8 ↓ 10		at 10' very calcareous

Drill Site Geologist: David L. Brown (Installed) Date: 4-13-88

Reviewed By: A. R. Rasmussen Date: 4/20/88

Borehole: E-53

Well Number: OB-1 37400

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
10	10	.7/2	6	10	SC	Same as above
11	12			12	SM	Silty sand fine to medium, 15% silt 10YR 5/6 yellowish brown, slightly moist low plastic med stite
12	12	2/2	7	12		
13	14			14	SC	Clayey sand, fine to medium 25% clay 10YR 5/6 yellowish brown, slightly moist med stite, low plastic, calc nodules
14	14	2/2	8	14		
15	16			16		
16	16	2/2	9	16		at 16' clay content increases to 35% grain size increases to fine to coarse
17	18			18		
18	18	2/2	10	18		at 18' clay increases to 45%
19	20			20		

Dave West - Installer

Drill Site Geologist: [Signature] Date: 4/15/89

Reviewed By: [Signature] Date: 4/20/88

Borehole: E-53

Well Number: OB-1 37406

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
20	20	.5		26	SC	Same as above, saturated at 20'
21	21	1/2	11	1		
22	22			22		
23	22			22		
24	24	0 1/2	11 1/2	6		No recovery from 22 to 25-5
25	24		12	24		
26	26	.5		26	SM	Silty sand, fine to very coarse, 5% gravel
27	26	1	13	26		85% 20% silt, 10% R6/4 light yellow brown,
28	25			28		saturated, non plastic, med dense
29	25	1/1	14	25		
30	29	1/1	15	29		
30	30			30		

Drill Site Geologist: [Signature]

Date: 4/1/88

Reviewed By: [Signature]

Date: 4/20/89

Borehole: E-53

Well Number: DB-1 37400

SOILS LOG
Description

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
30	30	.5 2	16	30 ↓ 32	SM	same as above
32	32	.5 2	17	32 ↓ 34		
34	34	.5 2	18	34 ↓ 36		gravel increases to 10% at 36'
36	36	0 2	19	36 ↓ 38		no recovery 36' → 38'
38	38				GP	Poorly graded gravel small to large (2.5") 30% sand fine to very coarse 10YR 5/4 yellowish brown Claystone bedrock mottled, very weathered, Soft claystone clasts in soft clay matrix Olive with blue-gray clasts
40	40					

Drill Site Geologist: [Signature]

Date: 4-15-88

Reviewed By: [Signature]

Date: 4/20/88

WELL CONSTRUCTION SUMMARY

Borehole E-53 032 Well 37401

Project Name and Location RMA OFF-ROCK SECT. 12 Project Number TASK 39

Drilling Company RYLES BROS. Driller TOM BIGH Rig Number B-61 Auger Rig

Drilling Method(s) AUGER w/ MOSS SYSTEM (6" AUGERS) THEN RETURN
HOLE TO T.D. w/ 12" AUGERS.

Borehole Diameter 12 in. 0 ft. 42 ft.
0 in. 0 ft. 0 ft.

Size(s) and types of Bit(s) 6 1/2" hollow stem auger
12" (OD) auger.

Size and Type PVC 2" sch. 40

Total Borehole Depth 42 ft. 0 cm.

Depth to Bedrock 41 ft. 0 cm.

Depth to Water 18.75 ft. 0 cm.

Water Level Determined By Solinst

Length Plain PVC (total) 18.44 ft. 0 cm.

Length of Screen + Endcap 25.24 ft. 0 cm.

Total Length of Well Casing 43.68 ft. 0 cm.

PVC Stick Up 1.63 ft. 0 cm.

Depth to Bottom of Screen 42.05 ft. 0 cm.

Depth to Top of Screen 16.81 ft. 0 cm.

Depth to Top of Sand 9.0 ft. 0 cm.

Depth to Top of Bentonite 3.0 ft. 0 cm.

Sampling Method(s) MOSS SYSTEM w/ Hollow Stem Auger

Date/Time Start Drilling 3/25/88 1026

Date/Time Finish Drilling 3/29/88 0913

Date/Time Start Completion 3/29/88 0950

Date/Time Cement Protective Casing 3/29/88 1500

Materials Used 10 ft. sect. surface casing.

Plain PVC (2) 10 ft. sections

Slotted PVC (2) 10 ft. sections (1) 5 ft. section.

Bentonite Pellets 2 buckets

Bentonite Granular N/A

Cement 3 bags

Sand 21 bags

Water added during completion ~ 110 gal.

Water added during drilling ~ 50 gal.

Total Gallons of water added ~ 160 gal.

Drill Site Geologist [Signature] Date 4/6/88

Weep hole & internal mortar: 4/6/88 SWP & RR
Cement pad: 4/1/88 SWP & SCS

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4/1/88 SWP & SCS

Date/Time/Personnel Casing Painted 4/1/88 SWP & SCS

Date/Time/Personnel Numbers Painted 4/6/88 SWP & BW 1300

Materials Used 10" & bags sacrete

Top of Protective Casing to Top of PVC 0.34 ft. 0 cm.

Top of Protective Casing to Weep Hole 1.49 ft. 0 cm.

Top of Protective Casing to Internal Mortar 1.51 ft. 0 cm.

Top of Protective Casing to Top of Cement Pad 1.79 ft. 0 cm.

Top of Protective Casing to Ground Level 1.97 ft. 0 cm.

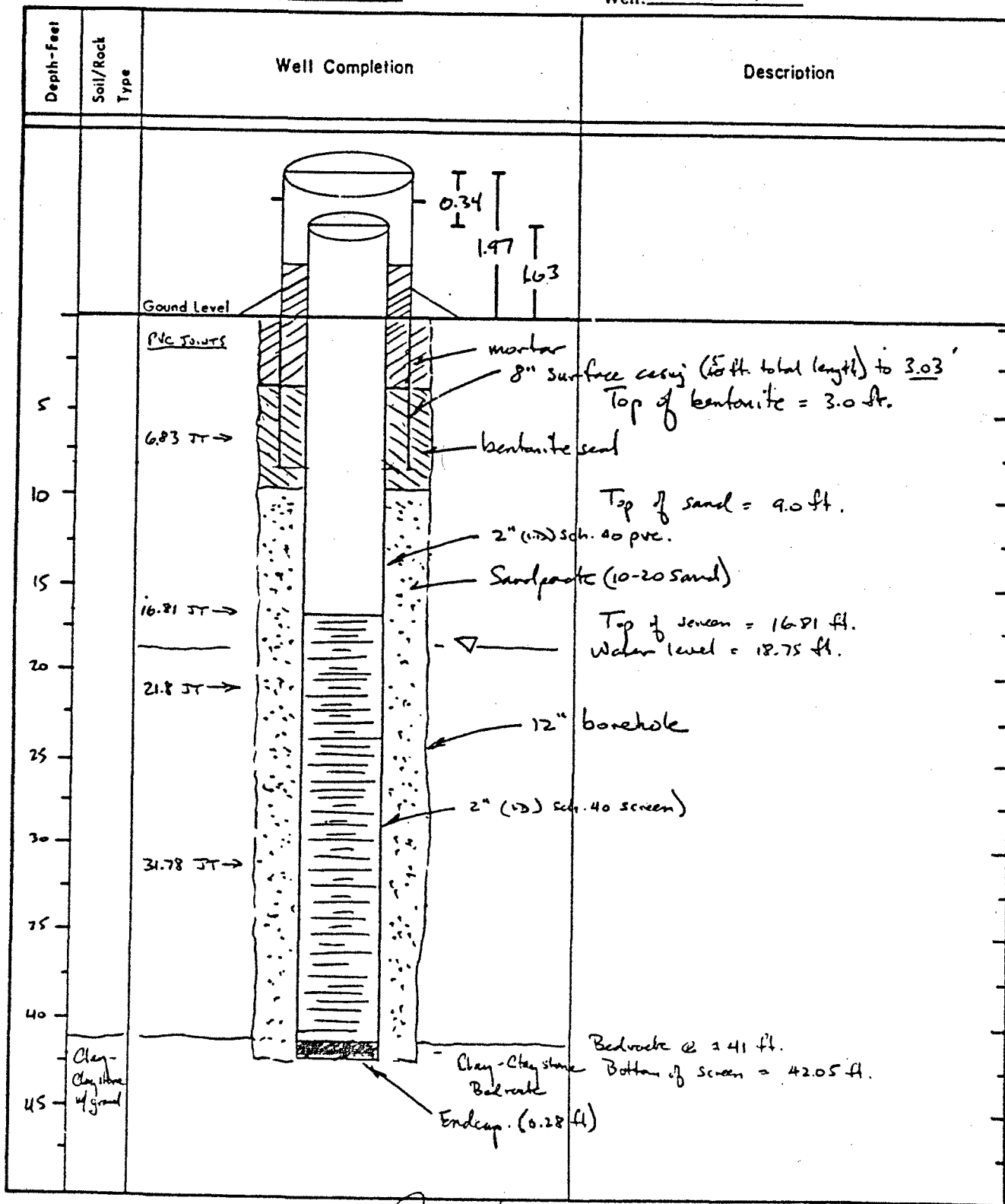
Reviewed By [Signature] Date 4/25/88

Drill Site Geologist [Signature] Date 4/6/88

COMMENT/NOTES

Borehole: E-53 002

Well: 37401



Drill Site Geologist: [Signature]
Reviewed By: [Signature]

Date: 4/6/88
Date: 4/25/88

Borehole: E-53400-2

Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
0					SC	SAND, 40% clay, fine to medium grained sand, 10 YR 4/4, dark yellowish brown, moist, low plastic, med stiff.
1	① 0 - 2.0'	2.0 2.0	1	0 - 2.0		
2					SM	SAND, 25% silt, fine to medium grained sand, 10 YR 6/4, light yellowish brown, med stiff, light moist, v. low plastic
3	② 2.0 - 4.0	1.1 2.0	2			
4						
5		9.0 2.0				
6						
7	③ 4.0 - 8.0	5.0 2.0	3			
8						SC SAND, 20% clay, fine to medium grained sand 10 YR 5/4 yellowish brown, stiff, moist, medium plastic
9	④ 8.0 - 12.0	2.0 2.0	4			
10	SR					

Drill Site Geologist: Dave West logged by Dave West Date: 4/15/88
Reviewed By: [Signature] Date: 4.20.88

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY, SUITE H-1
ENGLEWOOD, COLORADO 80112-3037/741-0839SHEET 2 OF 4Borehole: E-S308-2Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11	5 8.0' to 12.0'	1.4 2.0			SC	Sand, 20% clay, fine to medium grained, 10YR 5/4 yellowish brown, stiff, moist, medium plastic
12						No Recovery 12-15'
13		0 2.0				
14						
15	6 12.0' - 16.0'	0.8 2.0			SC	Sand, 40% clay, fine to coarse grained sand, 10YR 7/3 very pale brown, stiff, moist, medium plastic, calc.
16						
17	7 16.0' - 20.0'	2.0 2.0				at 16.5' Sand, 25% clay, fine to coarse grained sand, 10YR 5/4 yellowish brown, stiff, moist, medium plastic, calc.
18						
19		2.0 2.0				
20						20'

Drill Site Geologist: Dave WestLogged by Steve PaulDate: 4/15/88Reviewed By: [Signature]Date: 4-20-88

Borehole: E-53-082

Well Number: 37401

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20						No Recovery 20-21
21	24.0' - 24.0'	1.1/2.0			SP	SAND, 3% silt, fine to coarse grained, 10YR 5/4 yellowish brown, loose, saturated, non plastic
22					SM	SAND, 10% silt, fine to medium grained sand 10YR 5/4 yellowish brown, loose, saturated, non plastic
23	20.0' - 20.0'	2.0/2.0			SC	SAND, 20% clay, fine to v. coarse sand, occ. small gravel, 10YR 6/4 light yellowish brown, med dense, v. moist, low plastic
24						No Recovery 24-26'
25		1/2.0				
26	28.0' - 28.0'	2.0/2.0			SP	SAND, 3% silt, fine to very coarse grained, 5% small gravels, 10YR 6/4, light yellowish brown, med dense, saturated, non plastic
27	24.0' - 24.0'	2.0/2.0				
28						No Recovery 28-33.5'
29	28.0' - 32.0'	0.0/2.0				
30						

Drill Site Geologist: Dave West logged by Mike Paul Date: 4/15/88

Reviewed By: [Signature] Date: 4/26/88

Borehole: E-53-08-2

Well Number: 37401

SOILS LOG					
Depth-feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
30					No Recovery 28-33.5'
31					
32					
33	28.0' - 34.0'	0.4 2.0			GC Gravel, 5% Clay, small to medium (1") gravel, 10% 5/3, brown dense, saturated
34	32.0' - 34.0'				
35	34.0' - 36.0'	1.2 2.0			SP Sand, 5% oil; fine to very coarse grained sand, 5% gravel, small to medium gravel (2"), 10% 5/3, brown dense, saturated
36					
37					
38		0.4 4.0			Claystone bedrock, 5% 5/3 olive, weathered Fe stains
39					
40					
42	40.0' - 42.0'	1.1 2.0			TOTAL DEPTH 42'

Drill Site Geologist: Dave West Logged by Steve Paul Date: 4/15/88

Reviewed By: [Signature]

Notes: 4. 7.1.0.

WELL CONSTRUCTION SUMMARY

Borehole E-55A JR Well E55A #37382
Project Name and Location T-36 1/4 mile E of Yuma on 72nd Project Number 17063.074.10
Drilling Company Boyles Bros Driller Dave Jarvis Rig Number 545195V52
Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. _____ cm. _____ ft. _____ cm. to 97.5 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) _____

Size and Type PVC 4" .020 S/G

Total Borehole Depth 50.495 ft. _____ cm.

Depth to Bedrock 49 ft. _____ cm.

Depth to Water 37 ft. _____ cm.

Water Level Determined By Sample

Length Plain PVC (total) 35.25 ft. _____ cm.

Length of Screen 16.45 ft. _____ cm.

Total Length of Well Casing 51.7 ft. _____ cm.

PVC Stick Up 1.7 ft. _____ cm.

Depth to Bottom of Screen 50 ft. _____ cm.

Depth to Top of Screen 32.55 ft. _____ cm.

Depth to Top of Sand 20.5 ft. _____ cm.

Depth to Top of Bentonite 230 ft. _____ cm.

Sampling Method(s) Continuous Solid Spool

Date/Time Start Drilling 3/27 0905

Date/Time Finish Drilling 3/31 1000 1200/0001 REMARK

Date/Time Start Completion 3/31 1000

Date/Time Cement Protective Casing 3/31 1245

Materials Used 11 4' TUBES 5 BOXES

Plain PVC 4-10' BIRMS

Slotted PVC 1-10', 1-5'

Bentonite Pellets 5 BUCKETS

Bentonite Granular 50 / 60

Cement 11 BAGS

Sand 14 BAGS

Water added during completion 25 GALS

Water added during drilling 15 10 GALS 1000

Total Gallons of water added 40 GALS

Drill Site Geologist Greg L. H.

Date 3/31/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 04/08/87 11:00 PJB

Date/Time/Personnel Casing Painted 04/08/87 14:00 PJB

Date/Time/Personnel Numbers Painted 04/17/87 0930 PJB

Materials Used 14 Bags Quick-Crete 1/2 Bag Cement 1/2 Bag SAND

Top of Protective Casing to Top of PVC 0.425 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.1 ft. _____ cm.

Top of Protective Casing to Internal Mortar 1.2 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 1.9 ft. _____ cm.

Top of Protective Casing to Ground Level 2.1 ft. _____ cm.

Reviewed By Joseph L. Rud Date 4/20/87

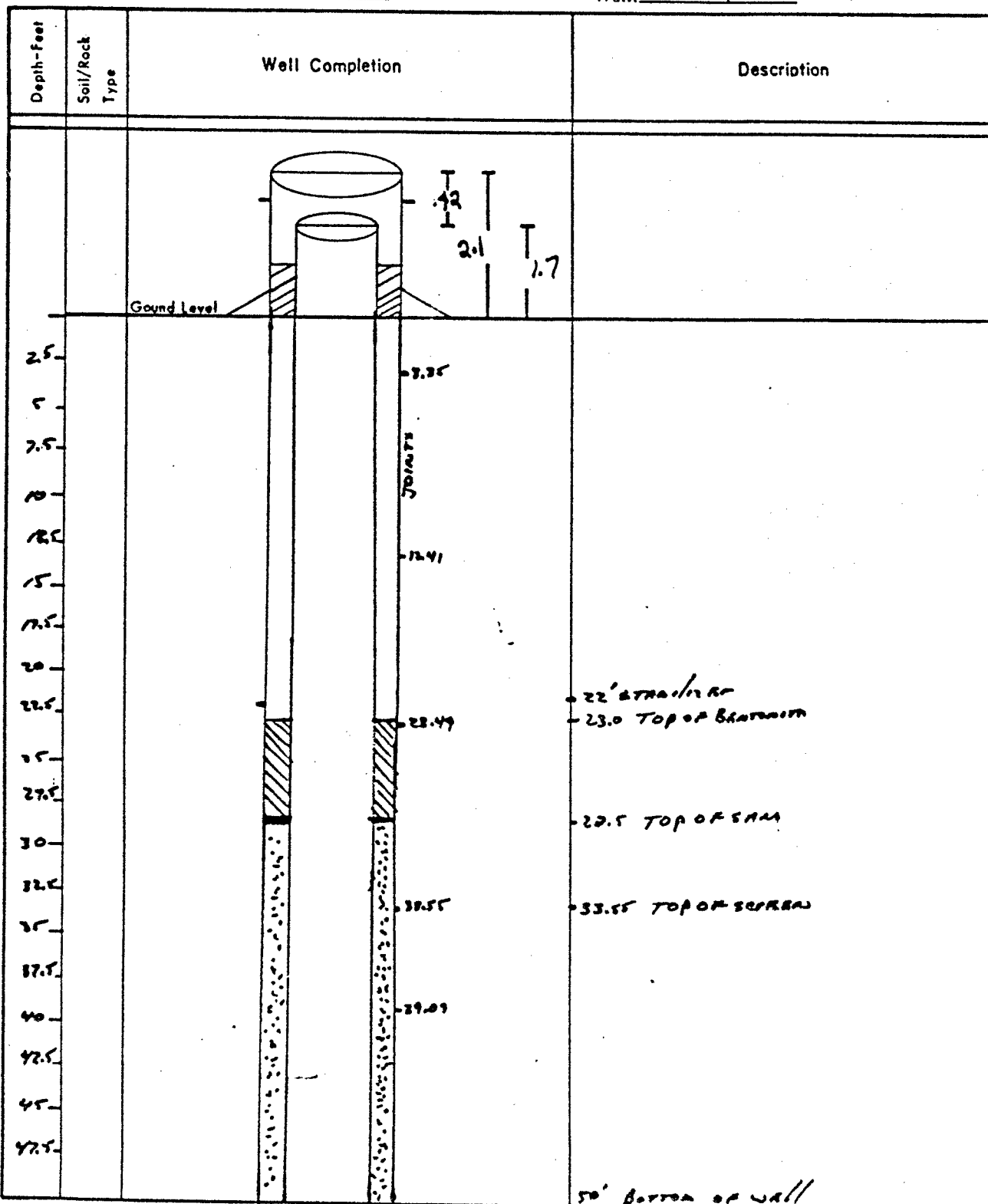
Drill Site Geologist _____

ESE ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-3037/41-0930

PAGE 2 OF 2

Borehole: E-55A

Well: E55A 37382



Drill Site Geologist: [Signature]

Reviewed By: [Signature]

Date: 3/31/87

Date: 4/20/87

Borehole: E55A

Well Number: 37382

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
2	C. 2	100%		0- 2	ML	SILTS with 10% fine sand, 10% clay. roots occas. 2.5y 3/2 very dark grayish brown, loose to ^{sl. moist} dense, nonplastic moist sl. chesnut (silt)
4	2- 4	100%		2- 4	SM	Silty sands - 10% silt, 3-5% clay, 2.5y 4/4 olive brown, loose to medium dense, nonplastic, dry occas. CaCO ₃ -rich areas visible (pervasive white)
6	4- 6	80%		4- 6		
8	6- 8	100%		6- 8	SW	SANDS - 2% silt, 2.5y 5/6 light olive brown, loose to med dense, nonplastic, sl. moist
10	8- 10	100%		8- 10		
12	10- 12	100%		10- 12	SM	Silty SANDS - 10% silt, 5% clay, 2.5y 5/6 light olive brown, medium dense, nonplastic, moist occas. CaCO ₃ -rich areas
14	12- 14	100%		12- 14		
16	14- 16	100%		14- 16		2% of silt decreasing gradually. samples dry beginning at 14'
18	16- 18	100%		16- 18		
20	18- 20	100%		18- 20	SW	SANDS - 2.5y 5/6 light yellowish brown, loose, nonplastic moist
22	20- 22	100%		20- 22		

Drill Site Geologist: C. B. W. E. J.

Date: 3.31.87

Borehole: E-55A

Well Number: 37382

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
22	22			22	SW SANDS - 5% small gravel (peasize), 2.5 y 6/4 light yellowish brown, loose, nonplastic, moist
	24	100%		24	
24	24			24	ML SILT - 10% Fine sand, 5% clay, 2.5 y 1/4 olive brown, (cohesive), nonplastic, moist
	26	80%		26	
26	26			26	ML SILT - 10% Fine sand, 5% clay, 2.5 y 1/4 olive brown, (cohesive), nonplastic, moist
	28	100%		28	
28	28			28	ML SILT - 10% Fine sand, 5% clay, 2.5 y 1/4 olive brown, (cohesive), nonplastic, moist
	30	100%		30	
30	30			30	ML SILT - 10% Fine sand, 5% clay, 2.5 y 1/4 olive brown, (cohesive), nonplastic, moist
	32	100%		32	
32	32			32	ML SILT - 10% Fine sand, 5% clay, 2.5 y 1/4 olive brown, (cohesive), nonplastic, moist
	34	100%		34	
34	34			34	SP Gravelly, Sands - small to 1/2" gravel 20%, 10 y 4/6 dark yellowish brown, loose, nonplastic, moist
	36	50%		36	
36	36			36	SP Gravelly, Sands - small to 1/2" gravel 20%, 10 y 4/6 dark yellowish brown, loose, nonplastic, moist
	38	50%		38	
38	38			38	SP Gravelly, Sands - small to 1/2" gravel 20%, 10 y 4/6 dark yellowish brown, loose, nonplastic, moist
	40	0%		40	
40	40			40	SP Gravelly, Sands - small to 1/2" gravel 20%, 10 y 4/6 dark yellowish brown, loose, nonplastic, moist
	42	50%		42	
42	42			42	SP Gravelly, Sands - small to 1/2" gravel 20%, 10 y 4/6 dark yellowish brown, loose, nonplastic, moist
	44	25%		44	
44	44			44	SS BEDROCK - TOP OF WATER TABLE

Drill Site Geologist: C. B. [Signature]

Date: 3-21-87

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112-3037/41-0638SHEET 3 OF 3

Borehole: _____

Well Number: 37382

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
44	43.5 to 45.5	100%		43.5 to 45.5	SS	SANDSTONE BEDROCK 10yr 4/6 dark yellowish brown, moderately indurated (friable), massive, saturated } sandstone very friable Rock now well indurated coarse sandstone (small lenses are common) FeOx staining common on some pebble-size clasts & cement
46	45.5 to 47.5	100%		45.5 to 47.5		
48	47.5 to 49.5	50%		47.5 to 49.5		
50					CS	49' - CLAYSTONE 10yr 3/3 dark brown, soft
END OF BORING AT 49.5'						

Drill Site Geologist: C. BensonDate: 3-31-8711/1/87

WELL CONSTRUCTION SUMMARY

Borehole E-58 Well 37368
Project Name and Location TASK 39: OFFPOST / PERUA 1/4 MI. W. OF 2 Project Number 86 946 0210
Drilling Company BOYLES BROS Driller DAVE JARVIS Rig Number B57 5451
Drilling Method(s) HOLLOW STEM AUGER

Borehole Diameter 12 1/4 in. _____ cm. 0.0 ft. _____ cm. to 33.7 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) 8 1/4 I.D., 12 1/4 O.D.
HOLLOW STEM AUGER

Size and Type PVC 4" SCHEDULE 40

Total Borehole Depth 34.8 ft. _____ cm.

Depth to Bedrock 34.0 ft. _____ cm.

Depth to Water 25.0 ft. _____ cm.

Water Level Determined By SAMPLE INSPECTION

Length Plain PVC (total) 19.78 ft. _____ cm.

Length of Screen 16.19 ft. _____ cm.

Total Length of Well Casing 35.97 ft. _____ cm.

PVC Stick Up 1.7 ft. _____ cm.

Depth to Bottom of Screen 34.27 ft. _____ cm.

Depth to Top of Screen 18.06 ft. _____ cm.

Depth to Top of Sand 12.8 ft. _____ cm.

Depth to Top of Bentonite 7.8 ft. _____ cm.

Sampling Method(s) CONTINUOUS AUGERING

Date/Time Start Drilling 12-19-86 / 1300

Date/Time Finish Drilling 12-22-86 / 1000

Date/Time Start Completion 12-22-86 / 1000

Date/Time Cement Protective Casing 12-22-86 / 1145

Materials Used _____

Plain PVC 2 - 10' SECTIONS

Slotted PVC 1 - 10' AND 1 - 5' SECTION

Bentonite Pellets 4.25 BUCKETS

Bentonite Granular 20 lb.

Cement (4) 50 lb. BAGS

Sand 13.25 BAGS

Water added during completion 15 GAL.

Water added during drilling 4.5 GAL

Total Gallons of water added 19.5 GAL

Drill Site Geologist M. Myall

Date 12-22-86

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed _____

Date/Time/Personnel Casing Painted _____

Date/Time/Personnel Numbers Painted _____

Materials Used _____

Top of Protective Casing to Top of PVC 2.30 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.29 ft. _____ cm. _____

Top of Protective Casing to Internal Mortar 1.25 ft. _____ cm. _____

Top of Protective Casing to Top of Cement Pad 1.45 ft. _____ cm. _____

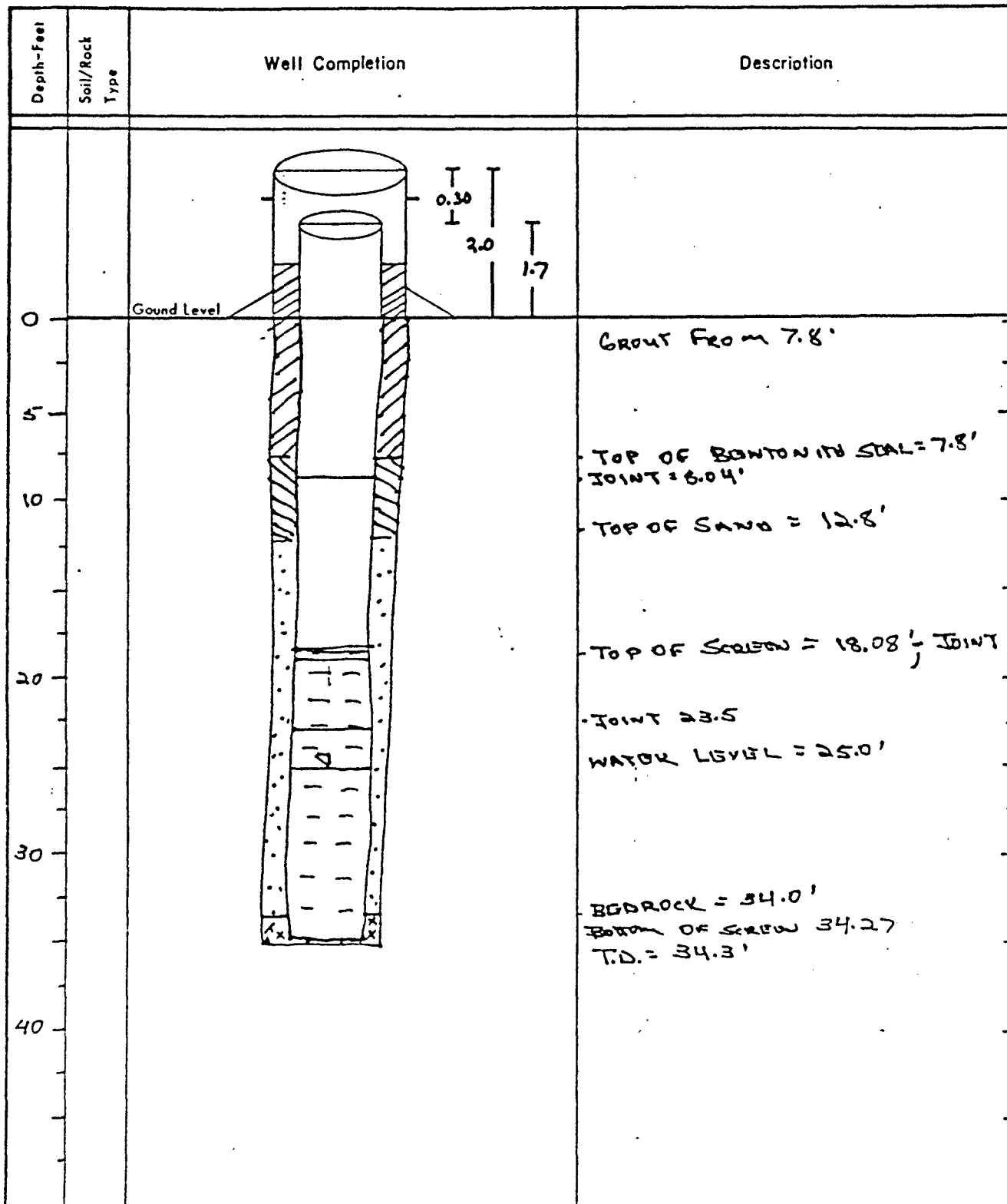
Top of Protective Casing to Ground Level 2.00 ft. _____ cm. _____

Reviewed By Joseph L. Reed Date _____

Drill Site Geologist _____ Date _____

Borehole: E-58

Well: _____



Drill Site Geologist: _____

Date: _____

Reviewed By: _____

Date: _____

ESE

7332 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-303741-0639

SHEET 1 OF 5

Borehole: E58Well Number: 37368

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0		1.0'	E58 ↓ All sample numbers below	0-5'	CL	CL, Sandy clay, 15% vtg sand, 10yr 3/4 drk ben, med plast, med stiff, moist Alluvium
1.0						
2.0		1.5'		2-4'	ML	ML, Sandy silt, 10% vtg sand, non plast, med stiff, 10yr 3/4 drk ywash ben, non-plast, med stiff moist Alluvium
3.0						
4.0		1.2'		4-5'		
5.0		1.3'		5-6'		color change 10yr 5/4 ywash ben
6.0						

Drill Site Geologist: W. J. J. J.Date: 12/22/86

Reviewed By: _____

Date: _____

Borehole: E 58Well Number: 37368

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
6.0		15'		6-7.0'	CL	CL, sandy clay, 30% vty sand, 10yr 4/4 dk ywash den, med plast, med stiff moist Alluvium
7.0		25'		7-7.5		color change to 10yr 5/4 ywash den silty clay
8.0						
9.0		45'		9-10.0		sandy clay, 20% vty sand
10.0		70'		10-11.0'	SC	SC, clayey sand, 40% clay, 10yr 4/4 dk ywash den, low plast, med stiff moist Alluvium
11.0		65'		11-12.0'		
12.0						

Drill Site Geologist: N. [Signature]Date: 12/22/86

Reviewed By: _____

Date: _____

Borehole: E57 Well Number: _____

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
12.0		.6'	12-	13.0	SC	SC, clayey sand, 10% clay, VF-fg sand, 10YR5/6 yellowish brown, non-plastic, LOOSE, moist Alluvium
13.0		.45'	13-	14.0		
14.0		.8'			SM	SM, silty sand, 10% silt, f-f 10YR5/4 yellowish brown, non-plastic LOOSE, moist Alluvium
15.0		NO REC	15-	18.0		NO RECOVERY
16.0						
17.0						
18.0						

Drill Site Geologist: N. Armstrong Date: 12/22/86
Reviewed By: _____ Date: _____

Borehole: E-58

Well Number: 37368

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
18.0		0.85'	18-20'	SP	SP	poorly graded, f-mg sand, 104R 5/4 ywash brn, non-plast, LOOSE moist Alluvium
19.0						
20.0		1.0'	20-22'	SW	SW	well graded f-c.g. 104R 6/4 Lt. ywash brn, non-plast, LOOSE, moist Alluvium
21.0						
22.0		1.5'	22-24'			moisture INCREASE to wet
23.0						
24.0						

Drill Site Geologist: W. G. Guttend

Date: 12/22/86

Reviewed By: _____

Date: _____

Borehole: E58Well Number: 37368

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
24.0 24.5 25.0		1.1'		24.26'	SW	SW - color change 10yr 4/4 BRK ywash brn ↓ moisture increase to SATURATED WATER TABLE AT 24.5
26.0 27.0		1.5'		26.2 27.5'		SP, poorly graded, m-c grained 10yr 4/4 ywash brn non-plast LOOSE SATURATED ALLUVIUM ↓
28.0 29.0		1.6'		27.5- 28.5	SP	SP, poorly graded sand, m-c grained, 10yr 4/4 ywash brn, non-plast, LOOSE, SATURATED ALLUVIUM (0.6' slough) ↓
30.0 31.0		1.5'		28.5- 30.0		
32.0		0.0		31.5 → 32.0		NO RECOVERY
33.0 34.0		3.0		32- 34.0	SP	SP, poorly graded sand, c-g, 10yr 4/4 ywash brn, non-plast LOOSE SATURATED ALLUVIUM ↓
35.0 36.0						CLAYSTONE BEDROCK AT 33.8' END OF BORING LOG WJA-

Drill Site Geologist: W. ArmstrongDate: 12/22/86

Reviewed By: _____

Date: _____

WELL CONSTRUCTION SUMMARY

Borehole E-59Well 37375Project Name and Location RMA T39, offport alluvialProject Number 17053.015.10Drilling Company Boyle BrothersDriller D. ErynRig Number E.R. TH-60Drilling Method(s) 12 1/2" O.D. H.S. Auger with 2x2" split screen sample barrelBorehole Diameter 12 1/2 in. 0 ft. 44.96' ft.
in. cm. ft. cm. ft. cm.Size(s) and types of Bit(s) 8" O.D. center bitSize and Type PVC 1" E.D. sch. 40Total Borehole Depth 44.96 ft. cm.Depth to Bedrock 44.50 ft. cm.Depth to Water 25.80 ft. cm.Water Level Determined By sample saturationLength Plain PVC (total) 19.89 ft. cm.Length of Screen 26.67 ft. cm.Total Length of Well Casing 46.56 ft. cm.PVC Stick U₁ 1.60 ft. cm.Depth to Bottom of Screen 44.96 ft. cm.Depth to Top of Screen 18.29 ft. cm.Depth to Top of Sand 12.85 ft. cm.Depth to Top of Bentonite 6.00 ft. cm.Drill Site Geologist James F. PearceSampling Method(s) Push sample w/ 2' barrelDate/Time Start Drilling 12/14/87 1425Date/Time Finish Drilling 12/15/87 1526Date/Time Start Completion 12/16/87 0902Date/Time Cement Protective Casing 12/17/87 0845Materials Used 5' 8" ID steel csg. protectivePlain PVC 19.89'Slotted PVC 26.67'Bentonite Pellets 30 gal 3/8" slope indicatorBentonite Granular 1/3 bag (50" bag)Cement 3 bags (100%) Type II MountainSand 20 1/4 bags (100%) 10-20 CSSFWater added during completion ~75 galWater added during drilling ~25 galTotal Gallons of water added 100 galDate 12-17-87Weep hole: 3-14-83/1425/DW & BWDate/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 3/11/88 1100 FS/RPDate/Time/Personnel Casing Painted 3/11/88 1100 FS/RPDate/Time/Personnel Numbers Painted 3/11/88 1105 FS/RP 3-14-83/1425/DW } DWMaterials Used 8 bags of cementTop of Protective Casing to Top of PVC 0.28 ft. cm.Top of Protective Casing to Weep Hole 1.48 ft. cm.Top of Protective Casing to Internal Mortar 1.51 ft. cm.Top of Protective Casing to Top of Cement Pad 1.72 ft. cm.Top of Protective Casing to Ground Level 1.75 ft. cm.Reviewed By James F. Pearce

Drill Site Geologist

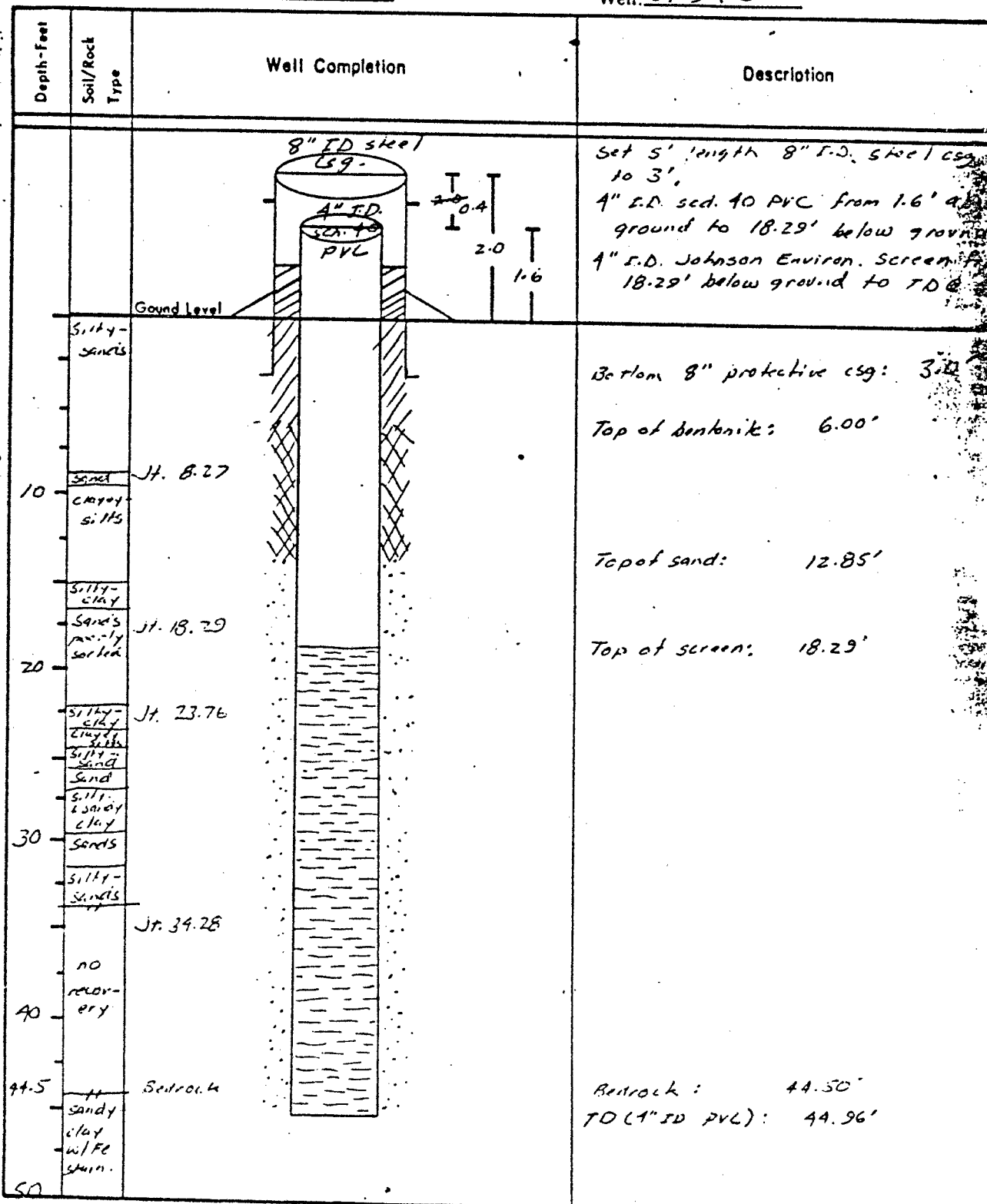
Date 3/16/88

Date

Date

Date

ESE ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY, SUITE M-1
ENGLEWOOD, COLORADO 80112-3031-0639

PAGE 2 OF 2Borehole: E-59Well: 37395
 Drill Site Geologist: Dr. F. France
 Reviewed By: Steve Brown

 Date: 12-17-87
 Date: 1/7/88

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112 • 303/741-0839SHEET 1 OF 6Borehole: E-57 wlf post RAH 730 Well Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						Munsell Colors
0			NA		SM	Silly sands; 20-40% silt, vf-f grained sands, 10YR 5/3 dark brn, root frags to 1.0'; loose, non-plas, moist alluvium.
1	2-0	1.8		2-0		At 1.0'; silty sands. 10-30% silt, vf-f sands. color changes to 10YR 4/4.3 brn to dark yellowish brn, occ root frags, loose non-plas, moist alluvium.
2						
3	4-2	1.7		4-2		
4						
5	6-4	2.0		6-4		

Drill Site Geologist: [Signature]Date: 12-17-87Reviewed By: [Signature]Date: 1/4/88

ESE ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112 • 303/741-0639

SHEET 2 OF 6Borehole: E-59 OffsetWell Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
7	8-9	1.8	NA	8-9		
8						
9	01-8	1.8		01-8	SP	At 8.6'; SP poorly graded sands, 10-20% med-coarse grained sand, 10YR 9/3; brn-dk brn, loose, non-plas, moist alluvium.
10					ML	At 8.8'; clayey silts, 10-20% clay, trace v.f. sand, 10YR 5/3 brn, mottled w/ CaCO ₃ 10YR 7/3, v. pale brn, loose, v. sl. plas, moist alluvium.
11	21-01	1.7		21-01		At 11.0'; CaCO ₃ absent
12						

Drill Site Geologist: AL 2 PonceDate: 12-17-87Date: 1/9/82

152

Borehole: E-50 PIMA T29

Well Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
12			NA			At 12.0'; clayey silts, clay increases to 20-30%, 10YR 5/4, yellowish brn, soft, sl plas, moist alluvium.
13	71-21	2.0'		71-21		
14						
15	91-16	2.0'		91-16		CL At 15.2'; silty clay, 20-30% silt, to vf-f grained sand, 10YR 5/4, yellowish brn, sl stiff, sl plas, moist alluvium.
16						
17	31-21	2.0'		31-21		SP At 16.2'; poorly graded sand, 10-20% of 10-20% med grained, 60-80% fine grained 10YR 6/4 light yellowish brn, loose non-plas, moist alluvium.

Drill Site Geologist:

J. F. Pounce

Date:

12-17-87

Date:

1/9/88

Borehole: E-59 RMA 739 Well Number: 37395

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
18			NA			No Recovery
19						
19.4						
20	19.4 - 21	1.8		19.4 - 21	SP	At 20.0'; pred. med sand, 20-30% coarse grained, some rf & v. coarse grains, subrounded, 10YR 6/4, lt. yell. brn, loose, non-plas, moist alluvium.
21						At 21.2'; pred. coarse grained, sm v.c. sands.
22	21 - 23	2.0		21 - 23	CL	At 22.2'; inorganic ^{silt} clay, 10-20% silt, 10YR 5/3 brown, soft, st-med plas, moist alluvium.
23						
24	23 - 25	1.8		23 - 25	ML	At 23.5'; clayey st silts, 10-30% clay, 10YR 5/4, yell. brn, loose, st plas moist alluvium.

Drill Site Geologist: JP

Date: 12-17-87

Reviewed By: Alan Plaw

Date: 1/9/88

E4

Borehole: E-59 RMA T39 Well Number: 37395

SOILS LOG						
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
24	23-25	1.8		23-25	SM	At 24.0'; silty sand, 30-40% silt, 10YR 5/4 yell. brn, loose, non plas, moist alluvium.
25						↓ No Recovery
26	25.5-27	1.5		25.5-27	SP	At 25.5'; poorly graded sands, pred med, 10-20% coarse, 10-20% v.f., some v. coarse, 10YR 5/4 yell. brn, loose, wet, alluvium, saturated at 25.8. <u>Water Table @ 25.8'</u>
27					ML	At 26.9'; clayey silts, 20-40% clay, 10YR 5/3 brn, soft, sl. plas, saturated alluvium. ↓ No Recovery
28	27.5-29	1.5		27.5-29	CL	At 28.0'; sandy clay, 10-20% sand (pred f-vf), 10YR 5/3 brn, sl stiff, sl plas, saturated alluvium. At 28.5'; At 28.8'; occ. mottled CaCO ₃ , 10YR 7/3 v. pale brn.
29					SP	At 29.2'; poorly graded, sub rounded, f. to pred med coarse sands, 10YR 5/4 yell. brn, loose, non-plas, saturated alluvium. At 29.8'; predom. coarse sands

Drill Site Geologist: [Signature] Date: 12-17-87
Reviewed By: [Signature] Date: 1/4/82

Borehole: E-59

Well Number: 37395

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
30			NA 1		At 30.0'; predom. v.c. sands.
					CL At 30.2'; silty clay, 10-50% silty, 10YR 5/4 brn, sl stiff, sl pks, saturated alluvium.
31	31-32	1.0		31-32	SM At 31.0'; silty sands, 20-40% silt, poorly graded w/ predom f-m. grained sand, some coarse to vc. sands, 10YR 5/3 brn, loose. non pks, saturated alluvium.
32					No Recovery 32.0 - 44.5'
44					No Recovery 32.0 - 44.5'
44.5	44.5-45.5	1.0		44.5-45.5	CL At 44.5'; sandy clay, 10-20% v.f. grained sand, 10YR 5/3.4 brn-dk brn, stiff, sl pks, abund Fe staining 10YR 6/8 brn yell. occ carbonaceous flakes,
45					
45.5					
END OF BORING LOG					

Drill Site Geologist: J. F. Pearce

Date: 12-17-87

Reviewed By: Stan Lane

Date: 1/9/88

WELL CONSTRUCTION SUMMARY

Borehole E-63A Well 37389

Project Name and Location TASK 39 Project Number _____

Drilling Company Boyles Bros Driller Dave Jarvie Rig Number 5451

Drilling Method(s) Auger

Borehole Diameter 7 1/4" OD in. _____ cm. 0 ft. _____ cm. to 36.0' ft. _____ cm.
reamed to 12 1/4" OD in. _____ cm. 0 ft. _____ cm. to 36.0 ft. _____ cm.

Size(s) and types of Bit(s) _____

Sampling Method(s) 2 ft wire-line runs

Size and Type PVC 4" Sch. 40

Date/Time Start Drilling 4/22 1212

Total Borehole Depth 36.0 ft. _____ cm.

Date/Time Finish Drilling 4/22 1402

Depth to Bedrock ~34.0m cm.

Date/Time Start Completion 4/23 1140

Depth to Water ~9 ft. _____ cm.

Date/Time Cement Protective Casing 4/23 1405

Water Level Determined By Sample saturation

Materials Used _____

Length Plain PVC (total) 10.1 ft. _____ cm.

Plain PVC 1X10'

Length of Screen 26.8 ft. _____ cm.

Slotted PVC 1X5', 2X10'

Total Length of Well Casing 36.9 ft. _____ cm.

Bentonite Pellets 1 1/2 buckets

PVC Stick Up 1.7 ft. _____ cm.

Bentonite Granular 2 bags X 50"

Depth to Bottom of Screen 35.2 ft. _____ cm.

Cement 15 1/2 bags X 94" (7 more before redrill)

Depth to Top of Screen 8.4 ft. _____ cm.

Sand 15 1/2 bags X 94" (7 more before redrill)

Depth to Top of Sand 7.1 ft. _____ cm.

Water added during completion 0

Depth to Top of Bentonite 3.0 ft. _____ cm.

Water added during drilling 20 gallons X 0% retained

Total Gallons of water added 0

Drill Site Geologist K.J. Matthews

Date 4/2

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 8AG 5/19/87

Date/Time/Personnel Casing Painted 06 03 87 1315 POB WTV

Date/Time/Personnel Numbers Painted 06 16 87 930 POB DLW

Materials Used 12 Bags Quikrete 112g Sand 1bag Cement

Top of Protective Casing to Top of PVC .25 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.12 ft. _____ cm.

Top of Protective Casing to Internal Mortar 1.15 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 1.54 ft. _____ cm.

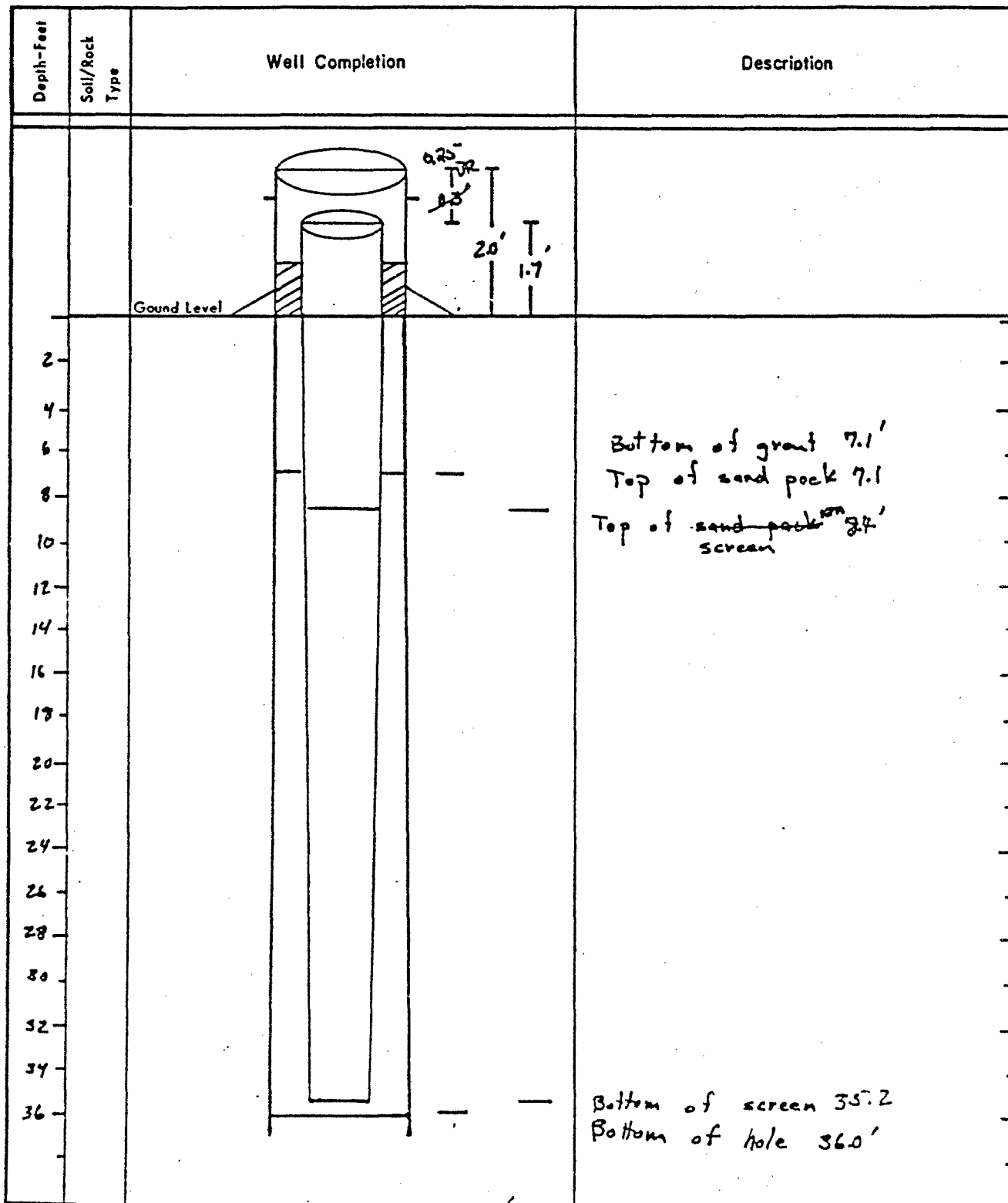
Top of Protective Casing to Ground Level 1.95 ft. _____ cm.

Reviewed By Joseph L. Reed Date 7/8/87

Drill Site Geologist K.J. Matthews Date 7/8/87

Borehole: E-63A

Well: 37389



Drill Site Geologist: K. J. McFarlane
Reviewed By: James L. Leland

Date: 7/8/87
Date: 7/9/87

no record of well
WELL CONSTRUCTION SUMMARY

Borehole E-03D1 Well 37390
Project Name and Location PMW Installation Project Number T36 17053074
Drilling Company Kayla Driller B. Roach Rig Number Fading 25
Drilling Method(s) rotary - bentonite mud

Borehole Diameter 7 7/8 in. _____ cm. 0 ft. _____ cm. to 26 ft. _____ cm.
3 7/8 in. _____ cm. 26 ft. _____ cm. to 46 ft. _____ cm.

Size(s) and types of Bit(s) 7 7/8" - blade

Sampling Method(s) not sampled

Size and Type PVC 4" sched. 40

Date/Time Start Drilling 4-23-87 0815

Total Borehole Depth 346 ft. _____ cm.

Date/Time Finish Drilling 4-23-87 0901

Depth to Bedrock 25 ft. _____ cm.

Date/Time Start Completion 4-23-87 0926

Depth to Water 3 ft. _____ cm.

Date/Time Cement Protective Casing 4-23-87

Water Level Determined By tape measure

Materials Used _____

Length Plain PVC (total) 41.32 ft. _____ cm.

Plain PVC 4x10" 1x3.5" cut off and piece

Length of Screen 5.88 ft. _____ cm.

Slotted PVC 1x5"

Total Length of Well Casing 47.7 ft. _____ cm.

Bentonite Pellets 1 1/2 buckets

PVC Stick Up 1.7 ft. _____ cm.

Bentonite Granular 34 bags

Depth to Bottom of Screen 334.6 ft. _____ cm.

Cement 7 1/2 bags

Depth to Top of Screen 40.17 ft. _____ cm.

Sand 1 1/2 bags

Depth to Top of Sand 39 ft. _____ cm.

Water added during completion 0

Depth to Top of Bentonite 34 ft. _____ cm.

Water added during drilling 0

Total Gallons of water added 0

Drill Site Geologist C Benson Date 4-23-87
⊗ sand pack usually 3-5 ft. but this smaller sand pack was done specifically at request of ESE staff.

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 5/19/87 RAG

Date/Time/Personnel Casing Painted 06-03-87 WTV PJB 1315

Date/Time/Personnel Numbers Painted 06-22-87 DLW PJB 13:50

Materials Used _____

Top of Protective Casing to Top of PVC 0.38 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.0 ft. _____ cm.

Top of Protective Casing to Internal Mortar 1.27 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 1.86 ft. _____ cm.

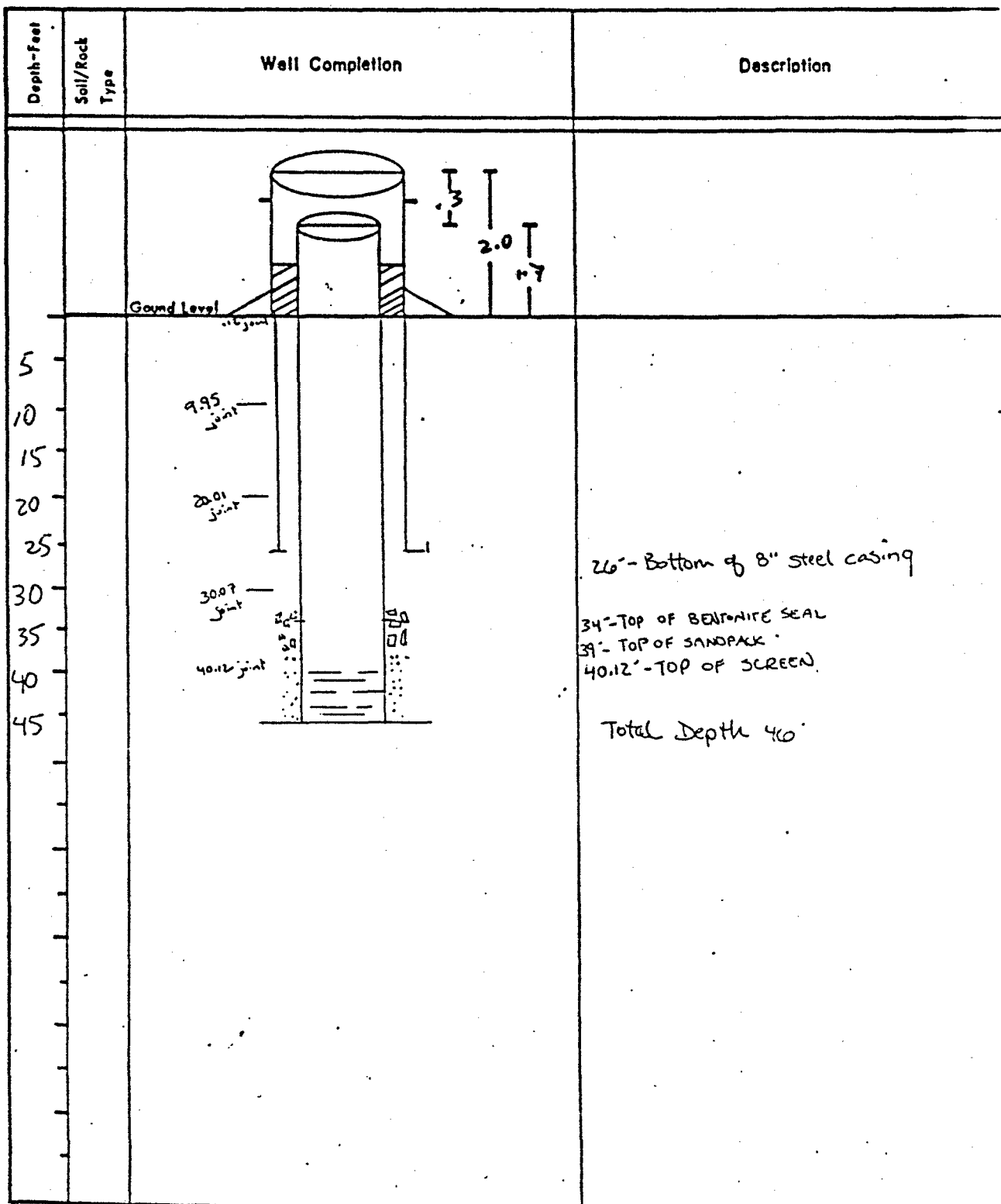
Top of Protective Casing to Ground Level 2.07 ft. _____ cm.

Reviewed By Joseph L. Reid Date 6/23/97

Drill Site Geologist _____

Borehole: E-63D1

Well: 3739D



Drill Site Geologist: C. Benson
Reviewed By: Joseph H. Reed

Date: 4.23.87
Date: 7/8/87

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7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112 • 303/741-0639PAGE 1 OF 1

BOREHOLE SUMMARY LOG

Borehole E-63 Well _____
Project Name and Location MW Installation - Task 36 Project Number 170520-410
Drilling Company Boyles Driller B. Roach Rig Number Fairing 25
Drilling Method(s) continuous core - rotary with bentonitic
drill mud
Size(s) and type(s) of bit(s) 7 7/8"
Borehole Diameter 7 7/8 in. _____ cm. 0 ft. _____ cm. to 26 ft. _____ cm.
3 7/8 in. _____ cm. 26 ft. _____ cm. to 63 ft. _____ cm.
Sampling Methods core
Total Number Soil Sampling Tubes _____
Total Number Core Boxes 3
Number of Gallons Lost Drilling Fluid 0
Date/Time Started Drilling 4.17.87 1700
Date/Time Completed Drilling 4.17.87 1400
Total Borehole Depth 63 ft. _____ cm.
Depth to Bedrock 21 ft. _____ cm.
Depth to Water 10 ft. _____ cm.
Water Level Determined By? tape
Borehole Completed as Monitoring Well? NO
Date/Time Grouting Completed 4.17.87 1600
Depth of Tremmie Pipe 60 feet
Gallons of Grout 50
Materials Used 50 gals. water, 5 bags cement, 1/2 bag bentonite
Comments _____

Wellsite Geologist C. Benson Date 4.17.87
Checked for Grout Settlement on 12/1/87 by Steve Pae
Amount of Grout Added none needed
All Measurements from Ground Level
Reviewed by Steve Pae Date 12/1/87
Drill Site Geologist _____ Date _____

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-303741-0638SHEET 1 OF 4

BR. = 23.5'

Borehole: E-63AWell Number: 37389

PRG 9/15/82

SOILS LOG						Description
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
0	0-2'	2.0'	N/A	0-1'	ML	ML - clayey silt. ~20% clay. 10YR 3/3 dk brown. Loose. Slightly plastic. Moist. Alluvium. Occasional white inclusions.
1						
2						
3	2'-11'	1.5'		2'-1'	SM	SM - silty sand. ~30% silt in f.g. sand. 10YR 4/4 dk yellowish brown. Loose. Non-plas. Wet. Alluvium.
4						
5	4'-6'	2.0'		4'-6'	ML	ML - sandy clayey silt. ~10% f.g. sand; ~20% clay. 10YR 6/3 pale brown. Loose. Slightly plastic. Wet. Alluvium. Grades into sand below.
6						
7	6'-8'	1.3'		6'-8'		~8' Water table noted in field.
8						
9	8'-10'	1.5'		8'-10'	SM	SM - silty sand. ~15% silt in f.g. sand. 10YR 6/4 light yellowish brown. Loose. Non-plas. Wet. Alluvium.
10	10'-12'	2.0'		10'-12'		

L48
Drill Site Geologist: K.J. MatthewsDate: 4/29/87Reviewed By: Joseph L. ReedDate: 7/9/87

Borehole: E-63A

Well Number: 37389

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
11	10'-12'	0.0'	N/A	10'-12'	sm
12	12'-14'	1.4'		12'-14'	From 12'-23.5' ^{5' LKM} 23.5' Sands become fine to medium grained.
13	14'-16'	0.0'		14'-16'	
14	16'-18'	1.1'		16'-18'	
15	18'-20'	2.0'		18'-20'	
16	20'-22'	2.0'		20'-22'	
17					
18					
19					
20					
21					
22					

LAB
Brill Site Geologist: R.J. Matthews

Date: 4/25/87

Reviewed By: Joseph L. Reed

Date: 7/9/87

Borehole: E-63 A

Well Number: 37389

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
22	22'-24'	1.4'	N/A	22'-24'		
23						Bedrock = 23.5' ^{PRG}
23.5					ML	ML - clayey silt. ~ 40% clay. Trace f.g.r. sand.
24	24'-26'	2.0'		24'-26'		10YR 4/1 dk. yellowish brown. Loose. Slightly pls.
25	26'-28'	2.0'		26'-28'		viol. Alluvium.
26	28'-30'	2.0'		28'-30'		At 25'
27	30'-32'	1.4'		30'-32'		Fine grain sand increases to ~ 10% of gtz, mica.
28	32'-34'	2.0'		32'-34'		At 25'
29						Fine grained sand increases to ~ 15%. Includes gtz, mica.
30						Color has tint of orange; black deposits. Non-plastic.
31						
32						

LAB
Drill Site Geologist: R.J. Millman

Date: 4/29/89

Reviewed By: Michael L. Reed

Date: 7/9/87

Borehole: E-63A

Well Number: 37389

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
33	32'-34'	2.0'	N/A	32'-34'	ML
34					
35	34'-36'	2.0'		34'-36'	CL
36					
End of Boring					

ML - sandy silt. ~ 40% f.gr. sand. Trace clay.
2.5% R5/2 grayish brown. Loose. Non-plastic.
Moist. Alluvium. Interbeds with clay below.

CL - silty clay. ~ 40% silt. 10% R3/1 v. dk. gray. Med. dense.
friable. Dry. Bedrock.

Drill Site Geologist: K.J. Matthews

Date: 4/29/82

Reviewed By: Joseph L. Reed

Date: 7/9/87

ESE, Inc. CORE LOG

By COB

Date 4-26-87 BORE E-63 Well(s)

Page 1 of 3

BOX no.	DEPTH Feet	Rec. Int.	Weather	Structure/ Bedding		Hard- ness	Perm.				Mineralogy		Color		Texture/ Grain Size				Lith. Char.	Lith. Class	Description/Comments
				Angle	Desc		1°	2°	3°	4°	Min	Habit	M	G	clst	sd	gr	mm			
	20																				
	22																				21" BEDROCK BEGINS
	24																				See Alluvium log for geology - CAKING SET TO 26 -
	26																				CEMENT TO 26"
	28				thin bedded, fine fracs.: 7-10/11																SILTY SANDSTONE
	30																				claystone interbed
	32																				Silty sandstone
	34																				
	36																				oxidation boundary at 36"
	38																				claystone
																					Silty sandstone

Inc. BORE E-63 WELL(S)

Box #	DEPTH Feet	U	S	Structure/ Bedding		Hard- ness		Perm		Mineralogy		Color	Texture/ Grain Size clst. ad gr. mm	Lith. Char	Lith. Class	Description/Comments
				Angle	Desc	S	H	1"	2"	Min	Habit					
	40				massive					mm's	1%	7.5		40	SS	SANDSTONE - well indurated (st. friable) silty, cement
					fracture					cm	1%	N6/0				
	42				massive					qtz.	1%	gray				
					coarse (fine) bedding					802						
										hills	10%					
	44															
										1"	cm			45	CL	CLAYSTONE AT 45'
					massive					cm	4%					
	46									fd	1%					
	48															
	50															
	52				heavily fractured									52	ST	SILTSTONE
	54				massive											
	56													56	CL	SANDSTONE
	58															
	60															
	62															
	64															
	66															
	68															
	70															
	72															
	74															
	76															
	78															
	80															
	82															
	84															
	86															
	88															
	90															
	92															
	94															
	96															
	98															
	100															

Inc. BORE E-63 Well(s) _____

ESE, Inc. CORE LOG

By COB

Date 4.26.87

BORE E-63

Well(s)

Page 3 of 3

Box No.	DEPTH	Rec. Int.	Width		Structure / Bedding		Hard-ness	Perm.		Mineralogy		Color	Texture / Grain Size clst sd gr mm .01 LO 100	Lith. Char.	Lith. Class	Description / Comments	
			U	S	Angle	Desc.		S	H	L	H						L
60	1.8					Massive						7.5 ⁴				CL	CLAYSTONE
62												N6/0					
63												gray					63' Total Depth

Frontier Logging

Lakewood, Colorado

ESE
E 63
RMA

Date APRIL 17, 1987

Driller	Depth	Time	Unit No.
63 Ft	1435	1455	
Bit	3 7/8"		
Coring	26 Feet		
Log	water + native mud		
Operator	W. Linton		
Location	Lakewood		

Scale	TC	Log Scale	Scale	TC	Log Scale
6 1/2 Ft	20	20	6 1/2 Ft	20	20
200 Scale	2	15	200 Scale	2	15
Calor Source	110		Calor Source	110	

Gamma (Analog)	Gamma (Digital)	Caliper	Temperature
Neutron Source No	Neutron Source No		
Closure	Azimuth	True Vertical	Survey Depth

NATURAL GAMMA
10 mv
S.P.
20 mv
RESISTANCE
20 OHMS/5 inches

NATURAL GAMMA

10 cps

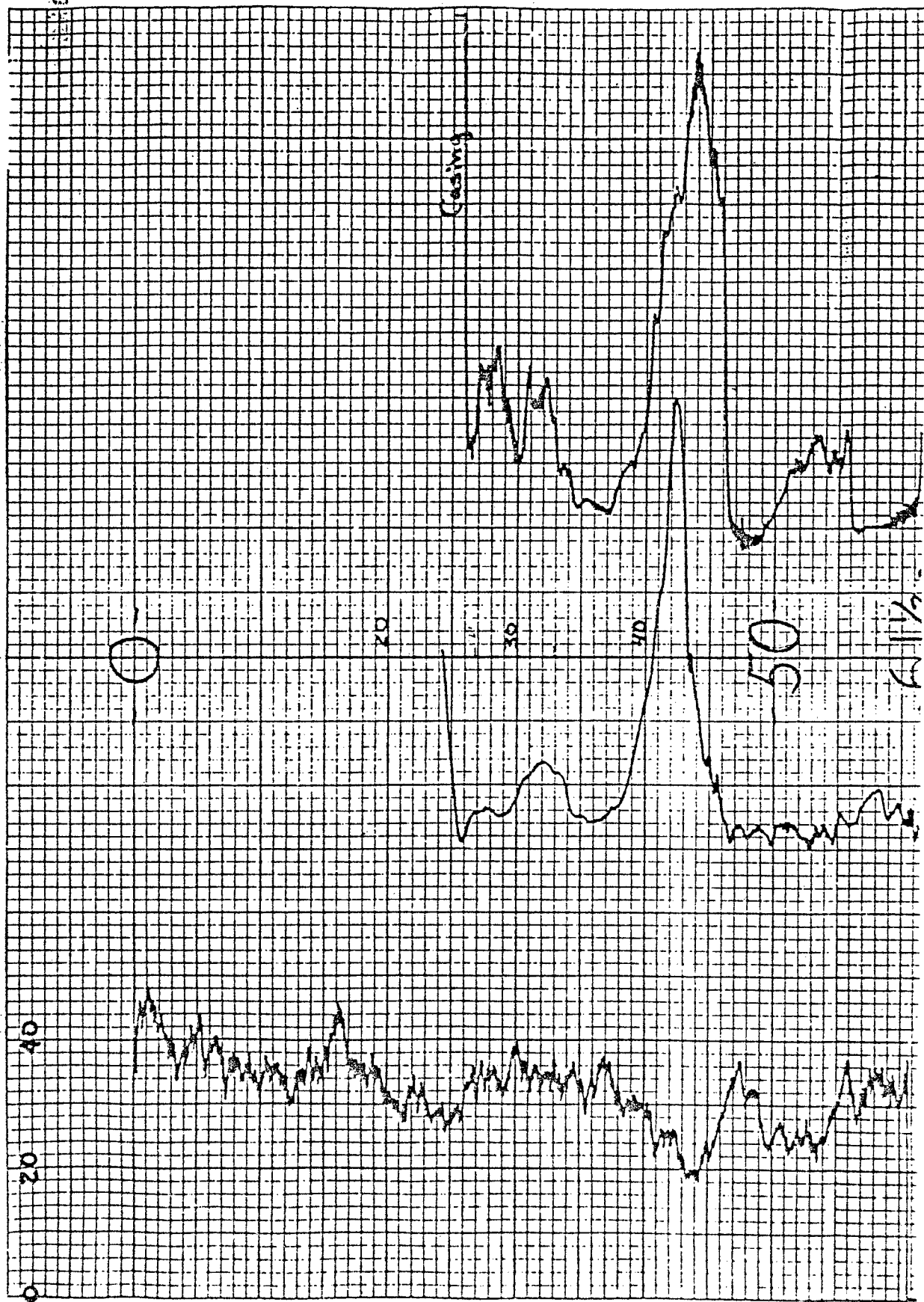
Actual Log

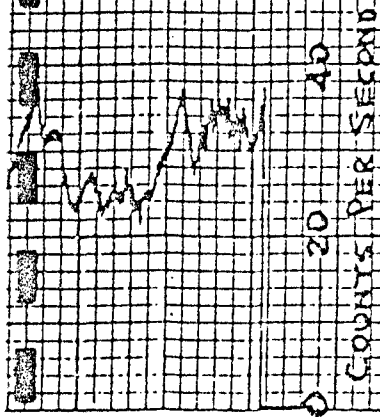
S.P.

20 mv

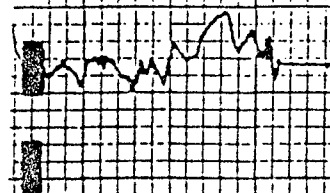
RESISTANCE

20 OHMS/5 inches

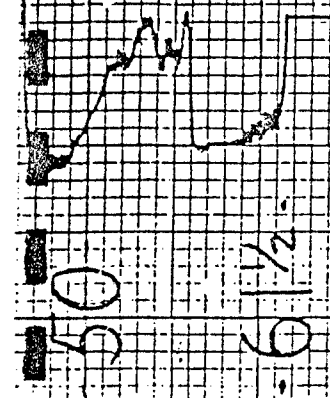




NATURAL
GAMMA



SP
20 MV/INCH



RESISTANCE
20 OHMS/INCHES

63

BOREHOLE SUMMARY LOG

Borehole E-64 Well Dry
Project Name and Location T-36 1/2 mile N of 95th on Plover Project Number 17063-074.10
Drilling Company Boyle Bros Driller DAVE JARVIS Rig Number 5451
Drilling Method(s) Auger

Size(s) and type(s) of bit(s) _____
Borehole Diameter 8 in. _____ cm. _____ ft. _____ cm. to 20.5 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Sampling Methods Continuous Split Spoon

Total Number Soil Sampling Tubes 3.25 - 4' TUBES

Total Number Core Boxes 2

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 0850 3/4/87

Date/Time Completed Drilling 3/4/87 1001

Total Borehole Depth 20.5 ft. _____ cm.

Depth to Bedrock 20.5 ft. _____ cm.

Depth to Water 0 Dry ft. _____ cm.

Water Level Determined By? SAMPLES

Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 3.4.87 1025

Depth of Tremmie Pipe IN AUGER

Gallons of Grout 60

Materials Used 4 BAGS OF CEMENT 20 lbs of BRANTONITE

Comments IN REVIEW WE MAY HAVE HIT A ROULDER TO GET
AUGER REFUSED

Wellsite Geologist Gray LA Date 6/11/87

Checked for Grout Settlement on 6/11/87 by JLR

Amount of Grout Added 0

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 6/11/87

Drill Site Geologist _____ Date _____

Borehole: E-64A

Well Number: ~~3775~~ (Dry)

SOILS LOG

Description

MUNSELL COLORS

Depth-Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
0.0			NA		SM	SM silty-sand, ~30-40% silt, 10 YR, 5/4-6, ywsh. brn., non-plas., loose, slightly moist alluvium.
1.0	0-2	1.2'		0-2		
2.0						
3.0	2-4	0.1'		2-4		No Recovery - AUGER LOSS
4.0					SM	At 4.0', percent silt decreases to ~10-20%, color changes to 10 YR, 4/4-6, dk. ywsh. brn.,
5.0	4-6	1.4'		4-6		
6.0						
7.0	6-8	1.5'		6-8		At 7.0' color changes to 10 YR, 6/6-8, brnsh. yellow,
8.0						
9.0	8-10	1.4'		8-10	ML	ML sandy-silt, 30-40% f. gr. sand, 10 YR, 5/6-8, ywsh. brn., non-plas., loose, moist, alluvium.
10.0	10-12	1.4'		10-12		
11.0						

Drill Site Geologist: A.E. Smith

Date: 3/13/87

Reviewed By: Joseph L. Reed

Date: 4/11/87

Well Number: E-64A

Well Number: 3205 Dry

SOILS LOG						Description
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
						MUNSELL Colors
11.0	10-12	1.4	NA	10-12	SC	SC Clayey - sand, ~30-40% clay, 10 YR, 7/3-4, v. pale brn., slightly pls., med. stiff, moist, alluvium.
12.0	12-14	1.5'		12-14		
13.0						
14.0	14-16	1.5'		14-16	SM	SM silty - sand, ~5-10% silt, 90-95% coarse g sand, 10 YR, 5/2-3 grayish brn., non-pls, loose slightly moist alluvium
15.0						
16.0						
17.0				16-18		NO RECOVERY -
18.0	16-20	0'		18-20		
19.0						AUGER LOSS
20.0		0.5'			ML	ML sandy silt, 10-15% v. f. gr sand, 10 YR, 7/3-4, v. pale brn., non-pls, med. stiff, dry alluvium.
20.5						END OF BORING LOG
21.0						
22.0						

Drill Site Geologist: [Signature]

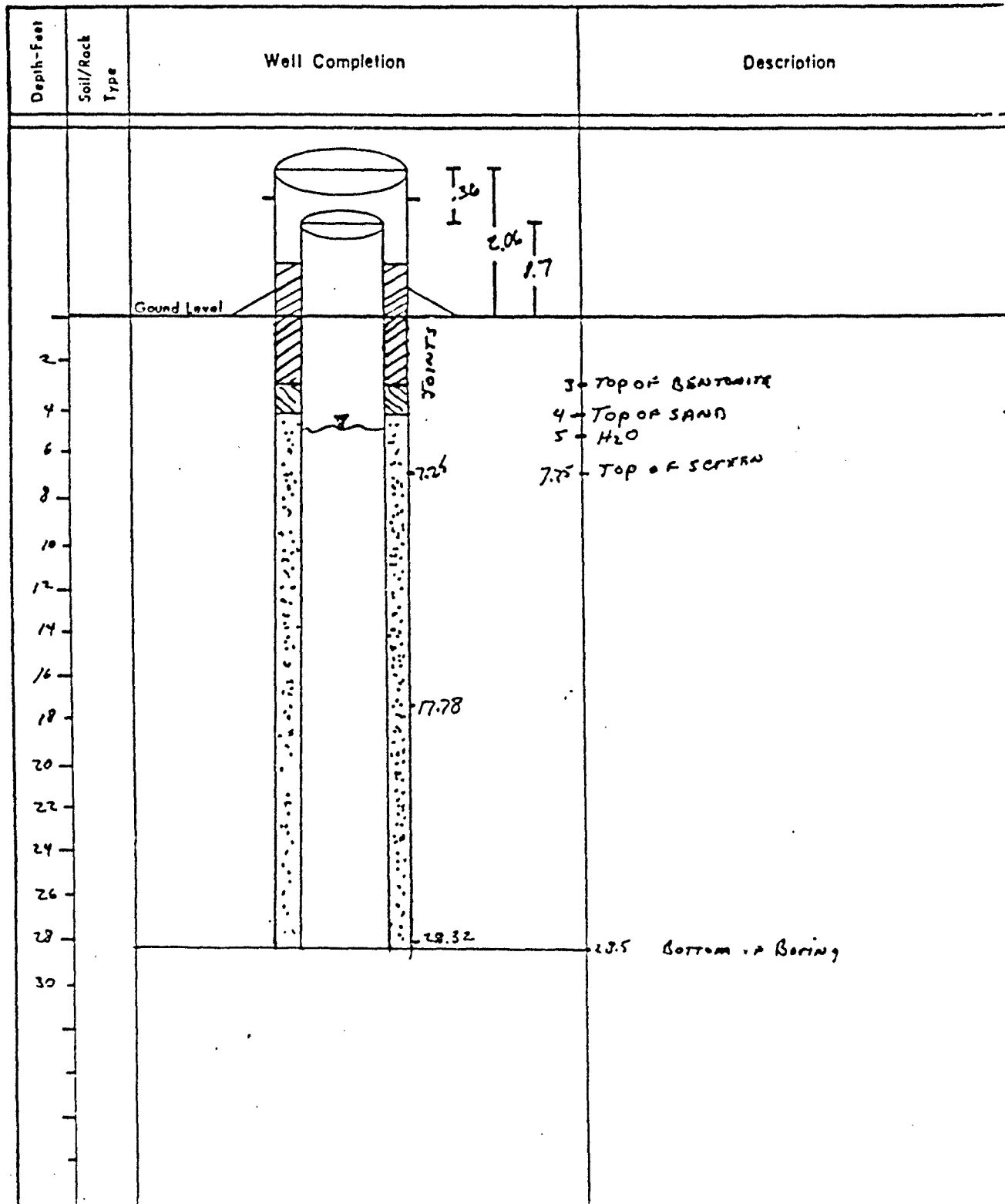
Date: 3/13/87

Reviewed By: [Signature]

Date: 4/16/87

Borehole: E-65A

Well: JR 37381
E-65A



Drill Site Geologist: Greg Lorus
Reviewed By: Joseph Reed

Date: 3/26/87
Date: 6/11/87

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7332 SOUTH ALTON WAY, SUITE H-1
ENGLEWOOD, COLORADO 80112-3037/741-0830PAGE 2 OF 2

WELL CONSTRUCTION SUMMARY

Borehole E-65A Well JR E-65A 37381
Project Name and Location T-36 1/2 mile NE of 94th & 1/2 mile W of P Project Number 17053 074.10
Drilling Company Boyls Bros Driller Dave Jarvis Rig Number 5451
Drilling Method(s) Auger

Borehole Diameter 12 in. 28.5 cm. 28.5 ft. 28.5 cm. to 28.5 ft. 28.5 cm.
12 in. 28.5 cm. 28.5 ft. 28.5 cm. to 28.5 ft. 28.5 cm.

Size(s) and types of Bit(s) _____

Size and Type PVC 4" 1020Total Borehole Depth 28.5 ft. 28.5 cm.Depth to Bedrock 28 ft. 28 cm.Depth to Water 5 ft. 5 cm.Water Level Determined By SAMPLESLength Plain PVC (total) 8.95 ft. 8.95 cm.Length of Screen 21.25 ft. 21.25 cm.Total Length of Well Casing 30.2 ft. 30.2 cm.PVC Stick Up 1.7 ft. 1.7 cm.Depth to Bottom of Screen 28.5 ft. 28.5 cm.Depth to Top of Screen 7.25 ft. 7.25 cm.Depth to Top of Sand 4 ft. 4 cm.Depth to Top of Bentonite 3 ft. 3 cm.Sampling Method(s) Continuous Split SpoonDate/Time Start Drilling 3/26/87 0845Date/Time Finish Drilling 3/26/87 1010 SW 1120Date/Time Start Completion 3/26/87 1120Date/Time Cement Protective Casing 3/26/87 1415

Materials Used _____

Plain PVC 1-10' LENGTHSlotted PVC 2-10' LENGTHSBentonite Pellets 1 BUCKETBentonite Granular 10 lbsCement 12 BAGSSand 18 BAGSWater added during completion 90Water added during drilling 0Total Gallons of water added 90Drill Site Geologist Greg LiviDate 3/26/87Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed RAG 5/19/87Date/Time/Personnel Casing Painted 06-03-87 0800 PJB/WTVDate/Time/Personnel Numbers Painted 06-03-87 1500 PJB/WTVMaterials Used 13 bags Bentonite 1 bag sand 1 bag cementTop of Protective Casing to Top of PVC 0.36 ft. 0.36 cm. COMMENT/NOTESTop of Protective Casing to Weep Hole 1.42 ft. 1.42 cm.Top of Protective Casing to Internal Mortar 1.43 ft. 1.43 cm.Top of Protective Casing to Top of Cement Pad 1.62 ft. 1.62 cm.Top of Protective Casing to Ground Level 2.06 ft. 2.06 cm.Reviewed By Joseph L. Reed Date 6/11/87

Drill Site Geologist _____ Date _____

Borehole: E-65A

Well Number: _____

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
	C-2	100%		0-2	ML Silts with ~ 30% clays - roots and twigs to 10% of sample S _u 3/2, dark olive gray, loose, nonplastic, moist
2	2-4	100%		2-4	ML Silts with 20% clays, now 5-10% sands (incl. to coarse 2.5 _u 3/2, very dark grayish brown, loose, nonplastic, moist
4	4-6	100%		4-6	SM <u>saturated</u> <u>SANDS</u> with 25% silt - Fine - 2.5 _u 5/4, light olive brown, loose, nonplastic, saturated also ~ 5% clay
6	6-8	100%		6-8	
8	8-10	100%		8-10	
10	10-12	100%		10-12	SM <u>H₂O increases in hole/sample</u> <u>SANDS</u> - 15% silt, 1% clay, 2.5 _u 5/6 light olive brown, loose, nonplastic, saturated
12	12-14	100%		12-14	
14	14-16	100%		14-16	
16	16-18	25% 100%		16-18	SM <u>SANDS</u> - 15% silt, 1% clay - sand coarser than previously - 10 _u 1/2, somewhat yellow, loose, nonplastic, sat.
18	18-20	100% 25%		18-20	SM <u>SANDS</u> - 15% silt, 1% clay - 2.5 _u 5/6 light olive brown, loose, nonplastic, saturated
20	20-22	100%		20-22	SP <u>SANDS</u> - 5% silt - sand is medium grained - 10 _u 1/2, brown, yellow, loose, nonplastic, saturated

Drill Site Geologist: C. [Signature]

Date: 2-3-87

Borehole: E-69A

Well Number: _____

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
22	22 - 23.5	100%		22 - 23.5	SP	SANDS - 5% silt - sand fine to medium grain size - 10 yr 6/6, brownish yellow, loose, nonplastic, saturated
24	23.5 - 25	100%		23.5 25		
26	25 - 26 26 - 27	100%		25 - 26 26 - 27		
28	27 - 29	100%		27 - 29	SS	NOTE: 1' sample intervals contain 2' of sample due to influx of sands in the augers
						28' BEDROCK - sandstone - slightly more indurated - occas. cement fragments in bedrock.
30						END OF BORING AT 29'

Drill Site Geologist: C. F. ...

Date: 3-31-87

WELL CONSTRUCTION SUMMARY

Borehole E-66A Well JE 566A 37386
Project Name and Location MW installation Project Number 7-25
Drilling Company Boyles Bros Driller Dave Jarvie Rig Number 5451
Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. cm. 00 ft. cm. to 50.6 ft. cm.
 in. cm. ft. cm. to ft. cm.

Size(s) and types of Bit(s)

Sampling Method(s) Auger

Size and Type PVC 4" ID

Date/Time Start Drilling

Total Borehole Depth 50.6 ft. cm.

Date/Time Finish Drilling 4/10/87 0802

Depth to Bedrock 50.0 ft. cm.

Date/Time Start Completion 4/10/87 0823

Depth to Water 46.5 ft. cm.

Date/Time Cement Protective Casing 4/10/87 1130

Water Level Determined By sample

Materials Used 25 2" liners

Length Plain PVC (total) 41.23 ft. cm.

Plain PVC

Length of Screen 10.89 ft. cm.

Slotted PVC

Total Length of Well Casing 52.12 ft. cm.

Bentonite Pellets 4 1/2 buckets

PVC Stick Up 1.7 ft. cm.

Bentonite Granular 1/2 bucket + 1/4 bucket

Depth to Bottom of Screen 50.4 ft. cm.

Cement 18 bags

Depth to Top of Screen 39.51 ft. cm.

Sand 9 bags

Depth to Top of Sand 34.7 ft. cm.

Water added during completion 5 gal/4.5

Depth to Top of Bentonite 29.7 ft. cm.

Water added during drilling 20 gal x 50% = 10 gal

Total Gallons of water added 10 gal + 15 gal

Drill Site Geologist K. J. Matthews

Date 4-10-87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 5/19/87 / 0900 / RAG + W

Date/Time/Personnel Casing Painted 06-03-87 1950 P28 WTK

Date/Time/Personnel Numbers Painted 06-16-87 0800 P28 DLW

Materials Used 15 Bags Quickcrete 1 bag sand, 1 Bag cement

Top of Protective Casing to Top of PVC 0.32 ft. cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.32 ft. cm.

Top of Protective Casing to Internal Mortar 1.35 ft. cm.

Top of Protective Casing to Top of Cement Pad 1.72 ft. cm.

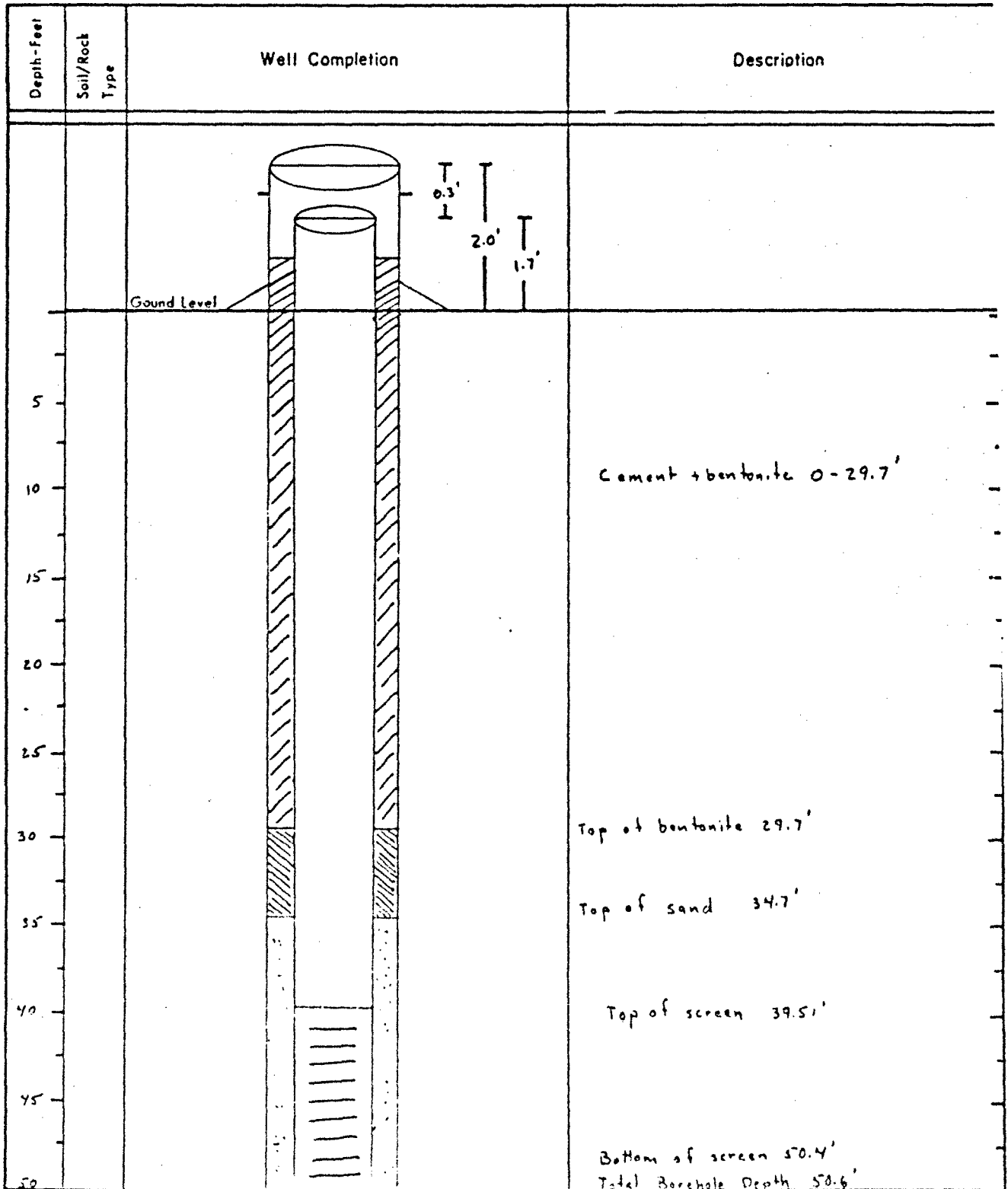
Top of Protective Casing to Ground Level 8.02 ft. cm.

Reviewed By Joseph Reed Date 6/19/87

Drill Site Geologist Date

Borehole: E 66 A

Well: 37386



Drill Site Geologist: Kevin Matthews

Reviewed By: [Signature]

Date: 9/26/83

Date: 12/1/87

Borehole: E-65A F-66A

Well Number: 37389^{JR} 37386

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
Munsell Colors						
0.0			NA		ML	<u>ML</u> sandy-silt, 10-20% v.f. gr. sand, 10 YR, 4/3-4, dk. br., non-pls., loose, moist, alluvium.
1.0	0-2'	2'		0-2'		
1.8						At 1.8', sandy-silt, 10-20% v.f. gr. sand, 10 YR, 7/2-3, v. pale br., non-pls., loose, dry, alluvium.
2.0						
3.0	2-4'	2'		2-4'		
4.0						
5.0	4-6'	2'		4-6'		At 5.0', sandy-silt, 40-45% v.f. gr. sand, 10 YR, 5/6-8, ywash. br., non-pls., loose, slightly moist alluvium.
6.0						
7.0	6-8'	2'		6-8'		
8.0						
9.0	8-10'	2'		8-10'		
10.0						At 10.0', sandy-silt, 10-20% v.f. gr. sand, 10 YR, 5/6-8, ywash. br., non-pls., loose, slightly moist alluvium.
10.0	10-12'	2'		10-12'		
11.2						

Lab
Date Site Geologist: AE Dattoli

Date: 4/9/87
4/16/87

Borehole: E-66A

Well Number: 37389^{5R} 37386

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						<i>Munsell Colors</i>
11.0	10-12'	2'	NA	10-12'	ML	<p>At 13.0, sandy-silt, ~ 10-20% v.f.gr. sand, 10 YR, 5/6-8, mottled w/ 5-10% calc. sand v.f.gr. sand, 10 YR, 8/1, white, non-pls., med. dense, slightly moist, alluvium.</p>
12.0	12-14'	2'		12-14'		
13.0	14-16'	2'		14-16'		
14.0	16-18'	2'		16-18'		
15.0	18-20'	2'		18-20'		
16.0	20-22'	2'		20-22'		<p>At 20.0, sand-silt, ~ 40% v.f.gr. sand, 10 YR, 5/6-8, ywash. brn., non-pls., loose, slightly moist, alluvium.</p>
17.0						
18.0						
19.0						
20.0						
21.0						
22.0						

Log
Drill Site Geologist: A. E. Ostberg
David L. Dool

Date: 4/9/87
4/11/87

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112 • 303/741-0839SHEET 3 OF 5Borehole: E-66AWell Number: 37389 ^{JE} 37386

SOILS LOG					
Description					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification
<i>Monsiee Cores</i>					
22.0			NA		ML
23.0	22-24'	2'		22-24'	↓
24.0	24-26'			24-26'	
25.0	26-28'	0'		26-28'	↓
26.0	28-30'			28-30'	
27.0	30-32'	2'		30-32'	↓
28.0	32-34'			32-34'	
29.0		2'			↓
30.0					
31.0		2'			↓
32.0					
33.0		2'			↓

ML clayey-silt, ~10-20% clay, 10 YR, 6/6-8, brownish yellow, slightly plus, soft, moist, alluvium.

— NO RECOVERY —

At 27.0', clayey-silt, ~20-30% clay, 10 YR, 5/4-6, green. brn., ~~low plus~~ mottled w/ r.f. gr. calc. sand, 10 YR, 8/1, white, low-med. plus., soft, moist, alluvium.

At 32.0', clayey-silt, ~5-10% clay, 10 YR 5/4-6 green. brn., slightly plus, soft, moist, alluvium.

Drill Site Geologist: A.S. [Signature]Date: 4/2/87Reviewed By: Michael L. ReedDate: 4/16/87

Borehole: E-66A

Well Number: 37389³² 37386

SOILS LOG					
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
<i>Monsieur Clear</i>					
33.0	32-34'	2'	NA	32-34'	ML
34.0	34-36'			34-36'	
35.0	36-38'	2'		36-38'	
36.0	38-40'			38-40'	
37.0	40-42'	2'		40-42'	
38.0					
39.0					
40.0					
41.0	42-44'	1.6'		42-44'	CL
42.0					
43.0					
44.0					

At 35.0'; clayey-silt, 30-40% clay, 10 YR, 4/4-6, dk. yash. brn., low-med. plas., med. stiff, moist, alluvium.

CL silty-clay, ~30% silt, 10 YR, 4/3-4, dk. yash. brn., med. plas., med. stiff, moist, alluvium.

At 42.0'; silty-clay, ~10% silt, 10 YR, 4/3-4, dk. yash. brn., med. plas., med. stiff, moist, alluvium.

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Drill Site Geologist: A.S. Dittels
Reviewed By: Orson L. Reed

Date: 4/9/87
Date: 4/16/87

Borehole: E-66A

Well Number: 37389^{SR} 37386

SOILS LOG						Description
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
						<u>Munsell Colors</u>
44.0	44-45	1'	NA	44-45	SP	<u>SP</u> gravelly-sand, 20-30% gtz. gravel, 10 YR, 5/6-8, yash. brn., non-pls., loose, moist, alluvial.
45.0	45-46	1'		45-46		
46.0	46-47	0.5'		46-47		<u>At. 46.5</u> gravelly-sand, 20-30% gtz. gravel, 10 YR, 5/6-8, yash. brn., non-pls., loose, <u>unsaturated</u> , alluvial.
47.0	47-48	0'		47-48		
48.0	48-49	0'		48-49		No Recovery - AUCR Loss
49.0	49-50	0'		49-50		No Recovery - AUCR Loss
50.0	50-51	0'		50-51		No Recovery - AUCR Loss
51.0	51-52	0'		51-52		No Recovery - AUCR Loss
52.0	52-53	0'		52-53		No Recovery - AUCR Loss
53.0	53-54	0'		53-54		No Recovery - AUCR Loss
54.0	54-55	0'		54-55		No Recovery - AUCR Loss
55.0						

END OF BORING LOG

Drill Site Geologist: A.E. Daulton

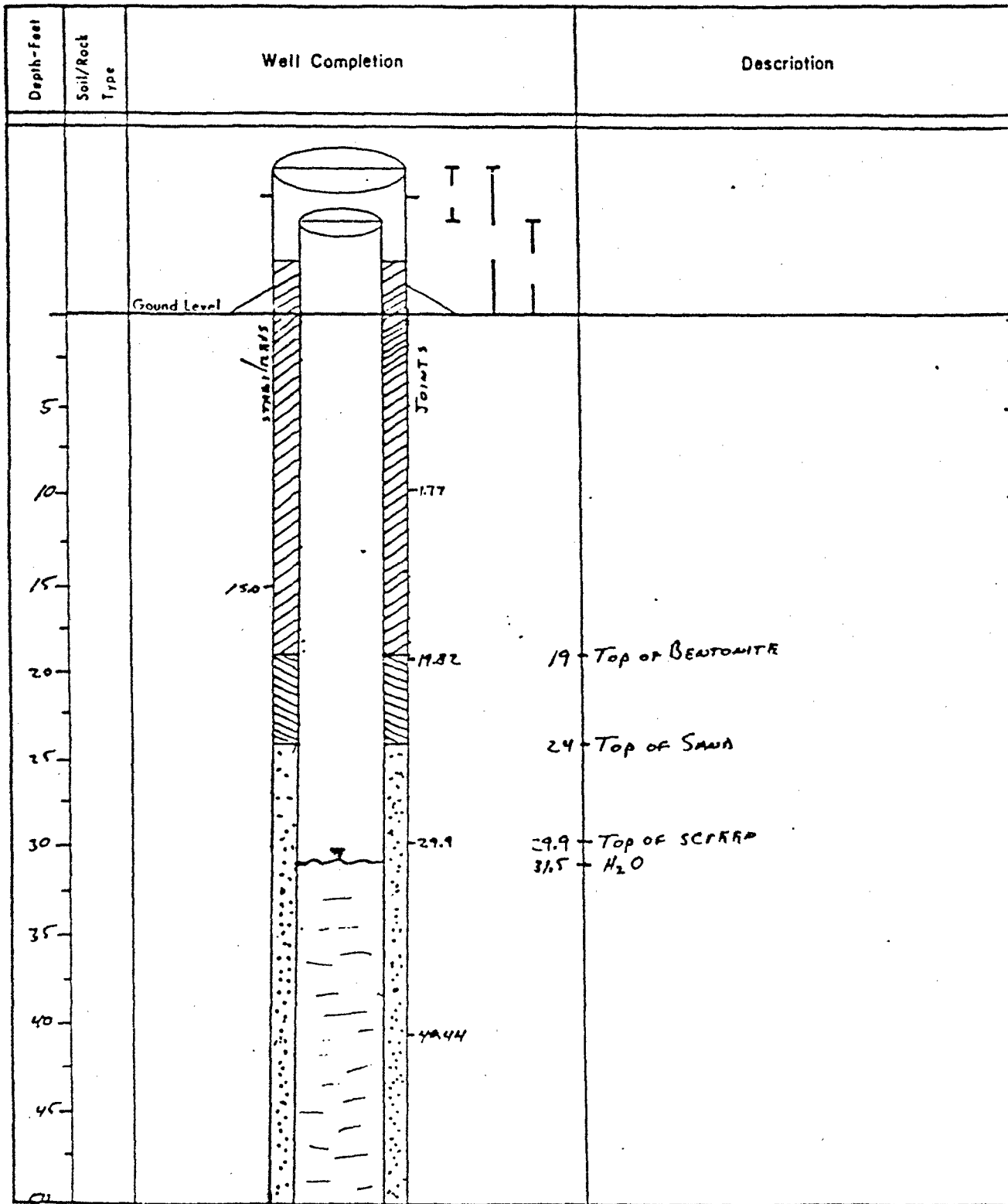
Date: 4/9/87

Reviewed By: Donald L. Reed

Date: 4/16/87

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ESE

ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7732 SOUTH ALTON WAY SUITE W-1
ENGLEWOOD, COLORADO 80112-303741-0838PAGE 1 OF 2Borehole: E-67AWell: JR 37385
E67ADrill Site Geologist: G. J. G. A.Date: 4/7/07

Reviewed By: _____

Date: _____

WELL CONSTRUCTION SUMMARY

Borehole GWL E-67A Well JR E-67A 37385
Project Name and Location T-25 YOSEMITE D 92ND Project Number _____
Drilling Company Buys Bros Driller Dave Jarvis Rig Number 5451
Drilling Method(s) AUGER

Borehole Diameter 12 1/4 in. _____ cm. 0 ft. _____ cm. to 51.39 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) _____

Size and Type PVC 4" .020 slot

Total Borehole Depth 51.39 ft. _____ cm.

Depth to Bedrock 51 ft. _____ cm.

Depth to Water 31.5 ft. _____ cm.

Water Level Determined By SAMPLES

Length Plain PVC (total) 31.6 ft. _____ cm.

Length of Screen 21.49 ft. _____ cm.

Total Length of Well Casing 53.09 ft. _____ cm.

PVC Stick Up 1.7 ft. _____ cm.

Depth to Bottom of Screen 51.39 ft. _____ cm.

Depth to Top of Screen 29.90 ft. _____ cm.

Depth to Top of Sand 24.0 ft. _____ cm.

Depth to Top of Bentonite 19.0 ft. _____ cm.

Sampling Method(s) CONTINUOUS Split Spoon

Date/Time Start Drilling 4/3/87 1330

Date/Time Finish Drilling 4/3/87 1626 DOES NOT INCLUDE RAB

Date/Time Start Completion 4/7/87 0830

Date/Time Cement Protective Casing 4/7/87 1120

Materials Used 22- 2' TUBES 46 CAPS

Plain PVC 3-10' SECTIONS + 1 CUT PIECE

Slotted PVC 2-10' SECTIONS

Bentonite Pellets 4.5 BUCKETS

Bentonite Granular 40/65

Cement 3 Bags

Sand 16 Bags

Water added during completion 35

Water added during drilling 15-ALL WATER WAS BROUGHT UP WITH CUTTING

Total Gallons of water added 50

Drill Site Geologist Gry

Date 4/7/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 5/19/87 RAG

Date/Time/Personnel Casing Painted 06-03-87 13:00 PJB-WTV

Date/Time/Personnel Numbers Painted _____

Materials Used 12 Bags Quikrete 1 Bag sand 1 cement

Top of Protective Casing to Top of PVC 0.25 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.57 ft. _____ cm.

Top of Protective Casing to Internal Mortar 1.54 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 1.77 ft. _____ cm.

Top of Protective Casing to Ground Level 1.95 ft. _____ cm.

Reviewed By Joseph L. Reed Date 6/11/87

Drill Site Geologist _____ Date _____

Borehole: E-67-1

Well Number: 37385

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
MUNSELL COLORS						
0.0	0-2'	2'	NA	0-2'	ML	ML clayey-silt, ~30-40% clay, 10YR, 5/2-3, greyish brn., non-plastic slightly plastic, v. soft, moist alluvium.
1.0						
1.7	2-4'	2'		2-4'		At 1.7', sandy-silt, ~20-30% v.f. gr. sand, 10YR, 4/3-4, dk. yellowish brn., non-plastic, loose, moist alluvium.
2.0						
3.0	4-6'	2'		4-6'		At 3.6', sandy-silt, ~30% v.f. gr. sand, 10YR, 6/4-6, light yellowish brn., non-plastic, loose, slightly moist alluvium.
3.6						
5.0	6-8'	2'		6-8'		At 5.5', sand-silt, ~40-45% v.f. gr. sand, 10YR, 6/6, brack. yellow, non-plastic, loose, dry, alluvium.
5.5						
6.0	8-10'	2'		8-10'	SM	SM silty-sand, ~30% silt, 10YR, 6/6-8, brack. yellow non-plastic, loose, moist, alluvium.
7.0						
8.0	10-12'	2'		10-12'	ML	ML clayey-silt, ~20% clay, 10YR, 5/4-6, yellowish brn., non-plastic slightly plastic, med. stiff, slightly moist, alluv.
9.0						
10.0	10-12'	2'		10-12'		
11.0						

Drill Site Geologist: A.E. Dettl

Date: 4/9/87

Borehole: E-67A

Well Number: 37385

SOILS LOG					
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
<i>MUSEUM COLORS</i>					
11.0	10-12'	2'	NA	10-12'	ML At 11.0', clayey-silt, ~ 30-40% clay, 10 YR, 5/6-8, ywash. ben., low pls., soft, moist, alluvium.
12.0	12-14'	2'		12-14'	
13.0	14-16'	2'		14-16'	At 13.0', clay-silt ~ 30-40% clay, 10 YR, 5/6-8, mottled w/ 5-10% calc. sand 10 YR, 8/1-2, white, low pls., soft, moist, alluvium.
14.0	16-18'	2'		16-18'	
15.0	18-20'	2'		18-20'	
16.0	20-22'	2'		20-22'	
17.0					
17.7					
18.0					SM SM silty-sand, ~ 20% silt, 10 YR, 7/4-6, v. pale ben. non-pls., loose, slightly moist, alluvium.
19.0					
20.0					ML ML clayey-silt, ~ 10-20% clay, 20% v. f. gr. sand, 10 YR, 5/6-8, ywash. ben., slightly pls., soft, moist, alluvium.
21.0					At 21.0', clayey-silt ~ 30-40% clay, 10 YR, 5/6-8, ywash. ben., low med. pls., soft, moist, alluvium.
22.0					

Drill Site Geologist:

A.E. Dittell
Dr. D. D. D.

Date:

4/9/87

4/11/87

Borehole: E-671

Well Number: 37385

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						MONTELL Colors
22.0			NA		ML	
23.0	22-24'	2'		22-24'		
24.0						
25.0	24-26'	2'		24-26'	CL	CL silty-clay, ~30% silt, 10 YR, 7/2-3, v. pale br low plas., soft, moist, alluvium.
26.0						
27.0	26-28'	2'		26-28'		
27.5						At 27.5', silty-clay, ~5-10% silt, 10 YR, 7/1-2, light gray, low plas., soft, moist, alluvium.
28.0	28-30'	2'		28-30'		
29.0						
30.0	30-32'	2'		30-32'		
31.0						
31.5	32-34'	2'		32-34'	SM	SM silty-sand, 10% silt, 10 YR, 5/4-6, good brn., non-plas., loose, saturated, alluvium.
32.0						
32.5						

442
Drill Site Geologist: A.L. Daulton

Date: 4/9/87

Reviewed By: Joseph L. Reed

Date: 9/16/87

Borehole: E-67A

Well Number: 37385

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
<i>Munsell Color</i>					
33.0	32-34'	2'	NA	32-34'	SP <i>gravelly-sand, 20-30% gte. gravel, 10 YR, 5/4- wash. br., non-pls., loose, saturated, alluvial</i>
34.0	34-35'	1'		34-35'	
35.0	35-37'	0'		35-37'	No Recovery
36.0					AUGER LOSS
37.0	37-39'	0.3'		37-39'	SM <i>silty-sand, 10-15% silt, 10 YR, 5/4-6, wash br., non-pls., loose, saturated, alluvial</i>
38.0	39-41'	0'		39-41'	No Recovery
39.0					AUGER LOSS
40.0	41-43'	0.3'		41-43'	SM
41.0	43-45'	0'		43-45'	No Recovery AUGER LOSS

Geologist: A.E. Dettling
Reviewed By: Joseph L. Reed

Date: 4/9/87
Date: 4/16/87

Borehole: E-67A

Well Number: 37385

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						MUNSHALL COLORADO
44.0			NA			NO RECOVERY - SURGE LOSS
45.0		0'				
46.0					SM	
47.0						
48.0						
49.0						
50.0					CL	CL sandy-clay, 20% med.-course gr. sand, 10 YR 4/2 dk gray ben., low plas., soft, wet, bedrock.
51.0						At 51.0 silty-clayst., 30% silt, 10 YR, 3/1, v. dk gray slightly plas., hard, wet, bedrock.
52.0						END OF BORING LOG
53.0						
54.0						
55.0						

Log
Geologist: J. L. Intelly Date: 4/9/87
Reviewed By: Joseph L. Reed Date: 4/16/87

BOREHOLE SUMMARY LOG

Borehole E-69 Well _____

Project Name and Location MW Installation Project Number 17053 0741

Drilling Company Boyle Driller Roach Rig Number Failing 25

Drilling Method(s) Rotary - with water

Size(s) and type(s) of bit(s) 12 1/4 rock, 7 7/8 tricone

Borehole Diameter 12 1/4 in. _____ cm. 0 ft. _____ cm. to 30 ft. _____ cm.
7 7/8 in. _____ cm. 30 ft. _____ cm. to 121 ft. _____ cm.

Sampling Methods Continuous Core

Total Number Soil Sampling Tubes —

Total Number Core Boxes 13

Number of Gallons Lost Drilling Fluid 0

Date/Time Started Drilling 2-11-87 1027

Date/Time Completed Drilling 2-12-87 1305

Total Borehole Depth 121 ft. _____ cm.

Depth to Bedrock 27 ft. _____ cm.

Depth to Water — ft. _____ cm.

Water Level Determined By? NOT Determined - drilled with water

Borehole Completed as Monitoring Well? No

Date/Time Grouting Completed 2-12-87 1506

Depth of Tremmie Pipe 120'

Gallons of Grout 80

Materials Used 3 bags cement, 30 gals water

Comments hole grouted to 10' of surface as requested by landowner,
Casing removed

Wellsite Geologist C Benson Date 3-23-87

Checked for Grout Settlement on 5-19-87 by CDE

Amount of Grout Added none

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 6/11/87

Drill Site Geologist _____ Date _____

100X DEPTH Feet	Reg Int.	U S	Structure/ Bedding		Maril- ness	Perm.			Mineralogy		Color (M) G	Texture/ Grain Size clst ad gr mm			Lith. Char	Lith. Class	Description/Comments CM (Scale 1" = <u>2</u> ft)
			Angle	Desc.		1°	2°	H	Min	Habit		OI	LO	100			
26																	BORING AUGERED and cased to 30' - NO LOG -
28																	
30																	
32	667.																silty 15% SS SS
34	4 5																
36																	
38																	33' 33'
40																	
42																	
44																	st/cls clay 40% (clay shale)
																	pea/lin on fracture faces ↓
																	2.5y 24% Hawk
																	LINE 43 L9

BORING AUGERED and
cased to 30' -
NO LOG -

pea/lin on fracture faces
↓

OXIDATION BOUNDARY

SE, Inc. BORE E-69 WELL(S)

platy
thick

2.5y
24%
Hawk

LINE

43
L9

ESE, Inc. CORE LOG

By BensonDate 2-13-87BORE E-69

Well(s) _____

Page 2 of 5

BOX No.	DEPTH Feet	Recon Int.	U	S	Structure/ Bedding		Hard- ness	Form.		Mineralogy		Color		Texture/ Grain Size clst or gr mm	Lith. Char.	Lith. Class	Description/Comments
					Angle	Desc.		1"	2"	Min	Major	M	G				
	46	5										2.5y					
		5										12/0					
		5										black				Lg	
(2)						scarcely broken											
	48					platy thick						2.5y				st	
												5/16				Lg	
	50	5										2.5y					
		5										12/0					
		5										black					
	52															51.5"	
						highly fractured						2.5y			clay 40%	st	
(3)												15/0					
	54	4				jts. 4-8 per foot						gray					
		4														Lg Frag.	
	56																
	58	4															
		4															
	60					jts. 10-12 per foot											
	62	4				jts. 4-6 per foot										Lg. Frag.	
		4															

WELL(S)

BORE E-69

E, Inc.

NO. (in circle)	DEPTH Feet	U	S	Structure/ Bedding		Hard- ness		Perm.		Mineralogy		Color		Texture/ Grain Size		Lith. Char.	Lith. Class	Description/Comments
				Angle	Desc.	S	H	L	H	Min	Horiz	M	G	clst	gr			
(4)	66				js. 12/Ft.											clay 20- 40%	st	
	68				js. 3/Ft.											Lg. frags		
	70																	
	72				js. 10-12/Ft.													
(5)	74				js. 3-5/ Ft.													
	76																	
	78																	
	80																	
(6)	82				js. 9-12/Ft.													

E. Inc. BORE E-69 WELL(S) _____

ROX No.	DEPTH Feet	U	S	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture/ Grain Size clst. or gr. mm	Lith. Char.	Lith. Class	Description/Comments
				Angle	Desc.		1"	2"	Mic	Habit					
												01 10 100			CM (Scale 1" = 2 ft)
⑥	86				0-1/ft				10% cln		2.5y N5/C gray		silty 57%	SS	
									bt 24%				bt 2%		
													Lg 10%		
	88														
	5				highly fractured to friable										
	5														
	90				jts 0-1/ft										
					highly fractured to friable										
⑦	92												91 very friable	Lg	
	5														
	5												93	cls	
	94														
					jts 0-4/ft (compacted vick)								95 med to coars	SS	
	96														
									cln 10%				97	cls	
	1.6														
	4														
	98														
	100														
	102										2.5y 4/2 gray brown				
	3.6														
	4														

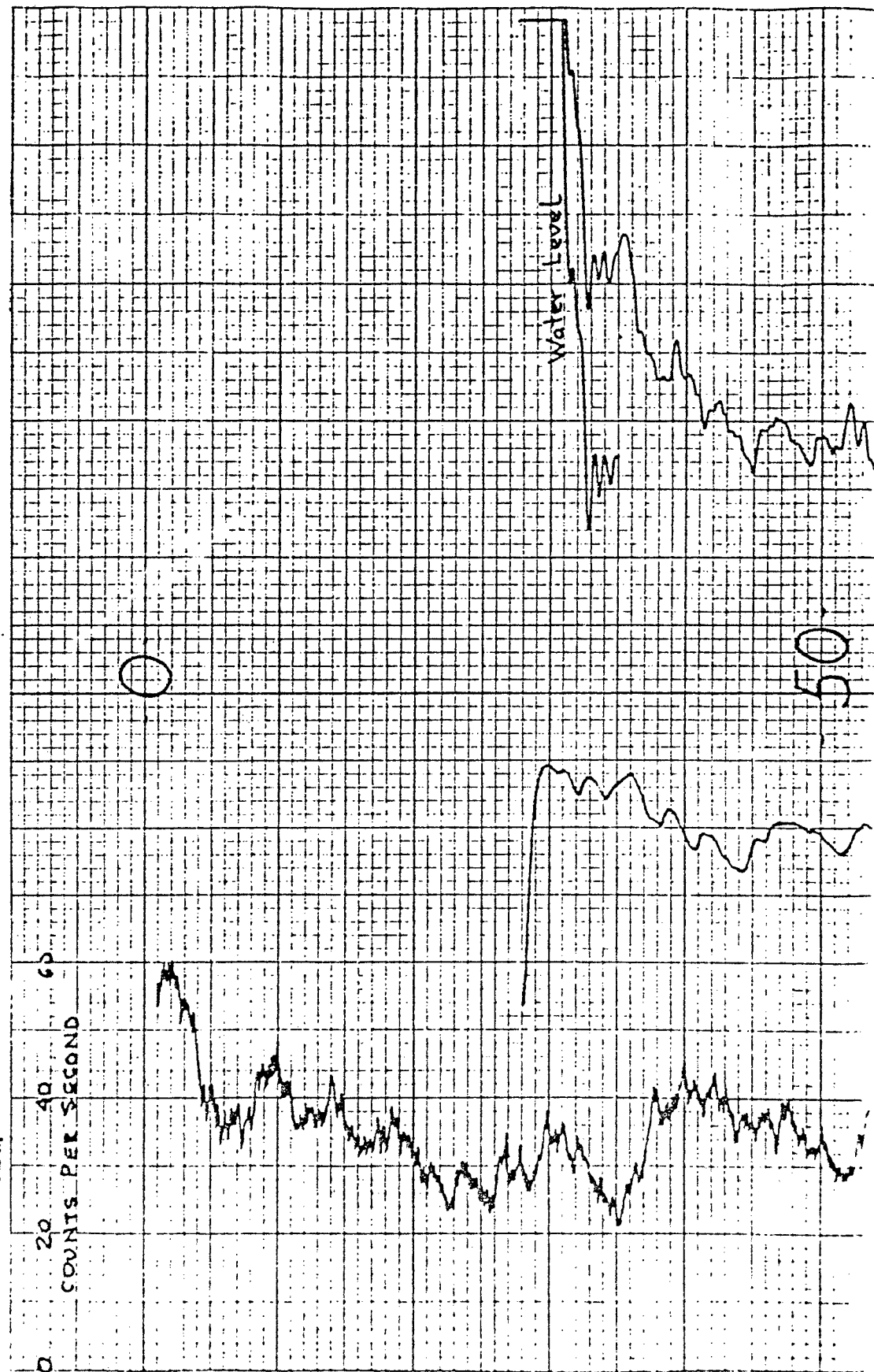
Carbon/liquite seam = 2"

no carbon to 104"

ESE, Inc. BORE E-69 WELL(S)

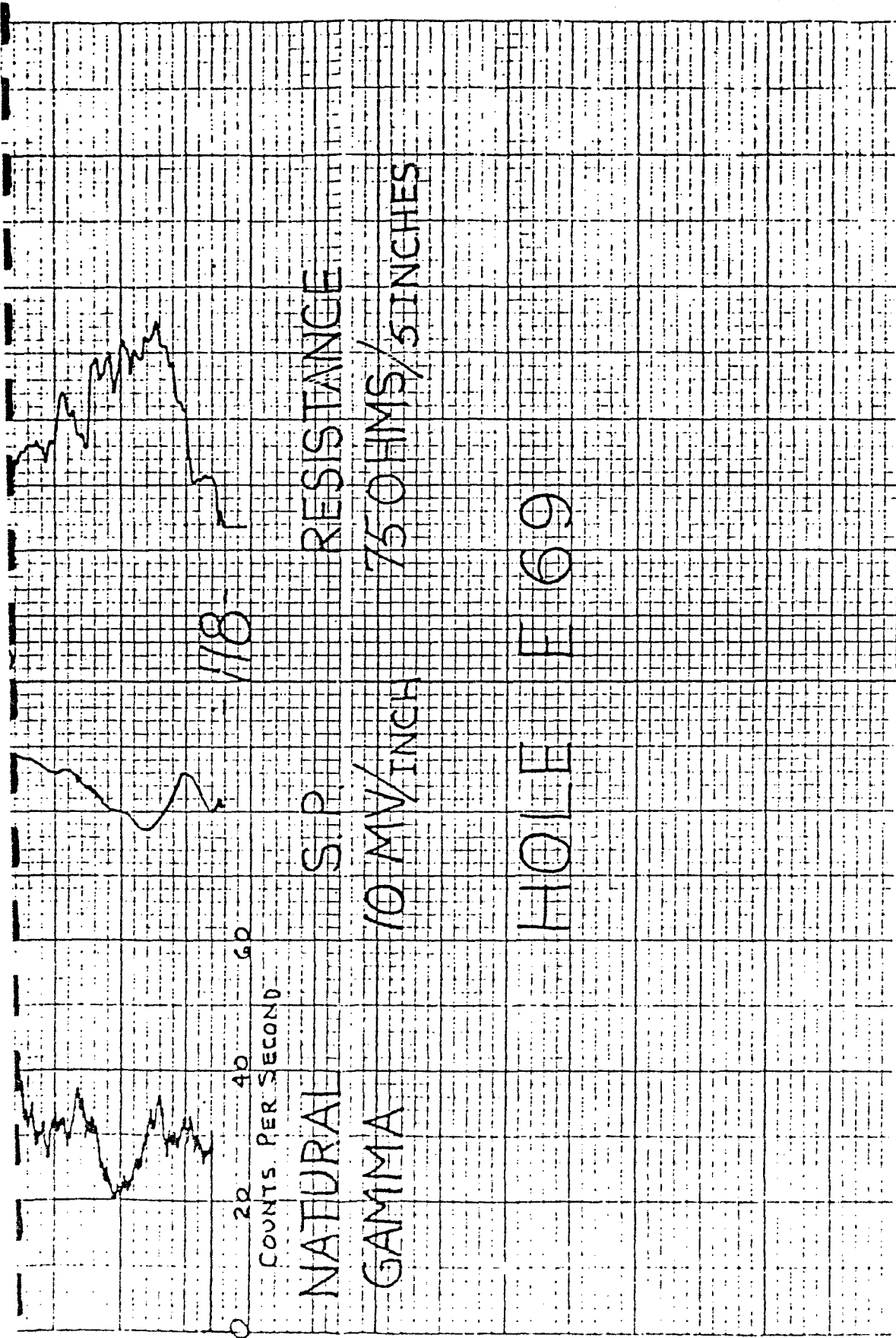
(Box no.)	DEPTH Feet	Rec. Int.	Structure / Bedding		Hard- ness	Perm.			Mineralogy		Color	Texture / Grain Size clst ad gr mm	Lith. Char.	Lith. Class	Description / Comments
			Angle	Desc.		S	H	L	Min	Habit					
			U	S		S	H	L	H						
											(M) G	01 10 100		Ft	CM (Scale 1" = 2 ft)
											2.5y			cls	
(8)	106	4 4									3/0 very dk nm				
											2.5y				
	108										5/0				
	110	4 4											104	SS	
													med. grained qtz. 60%		
	112												112	SS	
													5% quartz		
(9)	114	2.6 4											113		
													med grained qtz 60%		
	116												116	cls	
	118	5 5													
	120														
(10)	121														
															END OF HOLE 121'

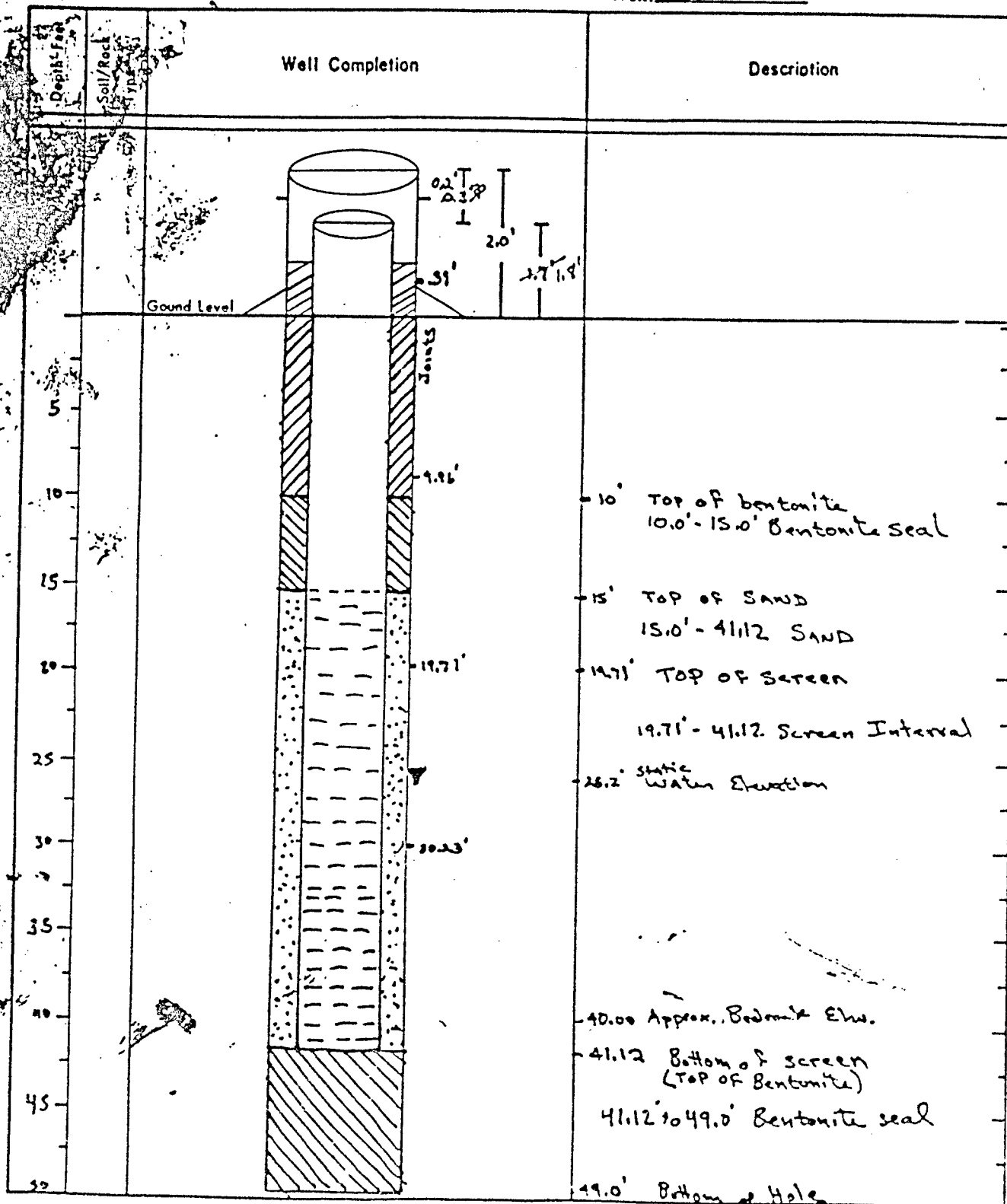
NATURAL GAMMA
 — 20 — 40 — 60 —
 S.P. — 10 MV —
 RESISTANCE — 75 — OHMS/5 inches





NATURAL GAMMA
COUNTS PER SECOND
S.P.
10 MV/INCH
RESISTANCE
75 OHMS/5 INCHES



Borehole: E-73AWell: 37391Drill Site Geologist: Steve ParrisReviewed By: Joseph L. ReedDate: 7/6/87Date: 11/5/87

WELL CONSTRUCTION SUMMARY

Borehole E-73A Well 37391

Project Name and Location Task 39 off post Project Number _____

Drilling Company Bayless Bros. Driller Don Irvine Rig Number TR

Drilling Method(s) Auger

Borehole Diameter 12 1/4 in. _____ cm. 0.0 ft. _____ cm. to 49.0 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) Hollow Stem Auger

Sampling Method(s) Continuous Split Spoon

Size and Type PVC 4" .020 slot

Date/Time Start Drilling 6/29/87 1341

Total Borehole Depth 49.00 ft. _____ cm.

Date/Time Finish Drilling 6/29/87 1031

Depth to Bedrock 40.00 ft. _____ cm.

Date/Time Start Completion 6/29/87 1047

Depth to Water 25.20 ft. _____ cm.

Date/Time Cement Protective Casing 6/30/87 0930

Water Level Determined By Sounding + samples

Materials Used 15-2" TUBES 30 caps

Length Plain PVC (total) 21.41 ft. _____ cm.

Plain PVC 2-10' section + 1 cut piece

Length of Screen 21.41 ft. _____ cm.

Slotted PVC 2-10' section

Total Length of Well Casing 42.82 ft. _____ cm.

Bentonite Pellets 13.5 buckets

PVC Stick Up 1.70 ft. _____ cm.

Bentonite Granular 5 1/8 bag

Depth to Bottom of Screen 41.12 ft. _____ cm.

Cement 5 bags

Depth to Top of Screen 19.71 ft. _____ cm.

Sand 18 bags

Depth to Top of Sand 15.0 ft. _____ cm.

Water added during completion 30 gal.

Depth to Top of Bentonite 10.0 ft. _____ cm.

Water added during drilling NA

Total Gallons of water added 30 gal

Drill Site Geologist STEVE PARIS

Date 7/2/87

Date/Time/Personnel Internal Mortar, Cement Pad and Weep Hole Installed 07/13/87/0900/ am

Date/Time/Personnel Casing Painted (white) 07/13/87/0930/ am

Date/Time/Personnel Numbers Painted 7/13/87 JLR

Materials Used 10 bags Sakrete

Top of Protective Casing to Top of PVC .20 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 1.95 ft. _____ cm.

Top of Protective Casing to Internal Mortar 1.95 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 1.94 ft. _____ cm.

Top of Protective Casing to Ground Level 2.0 ft. _____ cm.

Reviewed By _____ Date _____

Drill Site Geologist _____ Date _____

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112 • 303/741-0839PAGE 1 OF 1

BOREHOLE SUMMARY LOG

Borehole E-73 Well 37391
Project Name and Location Mhl Installation - Offroad Project Number Task 39
Drilling Company Boyles Driller B. Roach Rig Number Fairing 1500
Drilling Method(s) Rotary

Size(s) and type(s) of bit(s) 11' in. "auger", 5 7/8" Tricone bit
Borehole Diameter 11 1/2 in. 0 ft. 39 cm. to 111 ft. 111 cm.
3 1/8 in. 39 ft. 111 cm. to 111 ft. 111 cm.

Sampling Methods Continuous core

Total Number Soil Sampling Tubes —

Total Number Core Boxes 7

Number of Gallons Lost Drilling Fluid —

Date/Time Started Drilling 7-9-87 0918

Date/Time Completed Drilling 7-9-87 0837

Total Borehole Depth 111 ft. — cm.

Depth to Bedrock 36" ft. — cm.

Depth to Water — ft. — cm.

Water Level Determined By? —

Borehole Completed as Monitoring Well? NO

Date/Time Grouting Completed 7-9-87 1030

Depth of Tremmie Pipe 100"

Gallons of Grout 80 gals.

Materials Used 80 gals. water, 8 bags cement, 1 bag bentonite

Comments hole grouted to surface

Wellsite Geologist C. D. Benson Date 7-9-87

Checked for Grout Settlement on after pour by 11/18/87

Amount of Grout Added 0

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 11/18/87

Drill Site Geologist — Date —

Borehole: E-73A

Well Number: 37391

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
1'	1	0.0' - 2.0'			SM	Silty Sand, 30% silt, 2.5Y 6/2 light brownish grey, very loose, non plastic, moist
2'						
3'	2	2.0' - 4.0'				
4'						
5'	3	4.0' - 6.0'			CL	CLAY, 35% sand, fine to coarse grained, 2.5Y 7/4, pale yellow, very stiff, moist, calcareous low plastic
6'						
7'	4	6.0' - 8.0'			SC	gradual change to SC Clayey Sand, 25% clay, fine to coarse grained, moist 2.5Y 6/6 olive yellow, moist, calcareous
8'						
9'	5	8.0' - 10.0'			CL	Clay, 30% Sand, fine to coarse grained, 2.5Y 4/4 olive brown, very stiff, moist, calcareous low plastic
10'						

Drill Site Geologist: Steve Paine

Date: 11/1/87

Reviewed By: Joseph L. Lical

Date: 9/30/87

Borehole: E-73A

Well Number: 37391

SOILS LOG					
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification Description
11	6	10.0' - 12.0'	633	2.0'	CL Clay, 30% Sand, fine to coarse grained, 2.5Y 4/4 olive brown, very stiff, moist, very calcareous, low plastic
12					gradual change to SC
13	7	12.0' - 14.0'	673	2.0'	SC Clayey Sand, 20% clay, fine to coarse grained 2.5Y 4/4, olive brown, med dense, moist
14					color change from 14.5' to 15.0'
15	8	14.0' - 16.0'	714	2.0'	10YR 3/3 dark brown
16					Sm Silty Sand, 15% silt, fine to medium grained 2.5Y 5/4, light olive brown, med dense moist
17	9	16.0' - 18.0'	738	2.0'	
18					SP Poorly graded sands, 3% silt, fine to coarse grained, 2.5Y 6/4, light yellowish brown med dense, moist
19	10	18.0' - 20.0'	745	2.0'	
20					

Drill Site Geologist: Steve Pans

Date: 6/29/87

Reviewed By: Joseph L. Reed

Date: 9/29/87

Borehole: E-73AWell Number: 37391

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
21	11	20.0' - 22.0'			SP	SANDS ^{SP} Partly graded SANDS, 3% silt, fine to coarse grained, 2.5Y 5/4, light olive brown, med dense, moist
22						
23	12	22.0' - 24.0'				Sand grain size increase to: fine to very coarse grained including some small gravel (15%)
24						SANDS saturated 24'-25'
25	13	24.0' - 26.0'			SC	CLAYEY SANDS, 15% clay, fine to very coarse grained, 10YR 5/4, yellowish brown, med. dense, moist
26						sharp contact with gravel below
27	14	26.0' - 28.0'			GM GP?	Partly graded gravel Silty gravel, 15% silt, 30% sand, fine to coarse grained and small lined gravel, 10YR 5/4, yellowish brown, med. dense, saturated
28					SP	Partly graded sands, 10% silt, fine to very coarse grained 10YR 6/4, light yellowish brown, med dense, saturated
29	15	28.0' - 30.0'				No recovery after 28.0'. Suspect poorly graded sands and silty gravel flowing out of sampler while sampler was being removed from hole.
30						

Drill Site Geologist: Steve ParisDate: 6/29/87Reviewed By: Joseph L. ReedDate: 9/29/87

Borehole: E-73A

Well Number: 37371

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						<p>Continuous sampling method utilized to 49'. No recovery after 28.0', suspect unconsolidated sands and gravel flowing out of sampler or plugged auger resulted in no recovery from 28.0'-49.0'</p> <p>Estimate 4.0' of weathered bedrock from 36.0'-40.0'. Determined by increase torque on drill rig to auger through this depth</p> <p>Estimate bedrock at 40.0' by increase in torque from 40.0'-49.0'.</p>

Drill Site Geologist: Steve Paul

Date: 7/6/87

Reviewed By: Joseph L. Reed

Date: 9/29/87

BOX no.	DEPTH Feet	U	S	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture/ Grain Size clst sd gr mm 0.1 10 100	Lith. Char	Lith. Class	Description/Comments
				Angle	Dip		1"	2"	Min	Habit					
															CM (Scale 1" = <u>2</u> ft)
															Casing set to 39', bedrock at 36', core begins at 39'
	40										2.5y N6/2 lt. brown gray			CL	CLAYSTONE
	42														
	44														
	46														
	48														
	50														
	52														
	54														
	56														

E, Inc. BORE E73 WELL(S)

DEPTH Feet	U	S	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture/ Grain Size classified by API 1-100	Lith. Char.	Lith. Class.	Description/Comments
			Angle	Desc.		1°	2°	Min	Major					
60	5	5								2.5y			CL	CLAYSTONE
62										15% 9-11				
64	5	5												
66														
68	5	5												
70	5	5												
72														
74	5	5												
76														
78														
80														
82														
84														
86														
88														
90														
92														
94														
96														
98														
100														

WELL(S)

BORE E-73

ESE, Inc.

Massive
↓

coarse sandstone

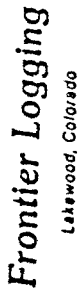
medium sandstone

finely bedded sandstone
most calcareous (7% calc)
has very regular (consistent)
COARSE SANDSTONE

[illegible]

NO. in DEPTH	Roc. Int.	U	S	Structure/ Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture/ Grain Size		Lith. Char	Lith. Class	Description/Comments
				Angle	Desc		1°	2°	Min	Habit		clst ad gr	mm			
						S	H	L	H	L	M	G	01 10 100			CM (Scale 1" = 2 ft)
100	4.2 5				massive				cbn 95%	pebb 2.54 N/A very dk				78	ST	SILTSTONE carbonaceous
102									2.54 NS/O gray					99		
104	5 5								cbn 30%	dk gray				104.1	SS	SANDSTONE
106									cbn frag. 20%							
108	4.2 5								cbn 10%	2.54 N/A dk. gray				106.5	CL	CLAYSTONE
110																
111																Total Depth 111'

ESE, Inc. BORE E-73 WELL(S)



Date July 9, 1987

County	ESE		Driller	111 FT		Idlers	Round Trip		Idlers
State	E-73		Bit	3 7/8"		Standby			
Area/Project	RMA		Casing	39 FT		Time	In		Out
County	ADAMS COUNTY		Fluid	water		Unit	No.		0945
Section			State	COLORADO		Density/	Operator		Wm. Linton
			Range	Elevation		Viscosity	Location		Lakewood
			Log Measured from	Ground Level		Drilling Measured from		Ground Level	

[illegible][illegible]

NATURAL CAUSE

5.2

NATURAL GAMMA

20

CS

20 MV

S.P.

+

RESISTANCE

40 OHMS/ 5 inches

NATURAL GAMMA

20 cps

Initial Log

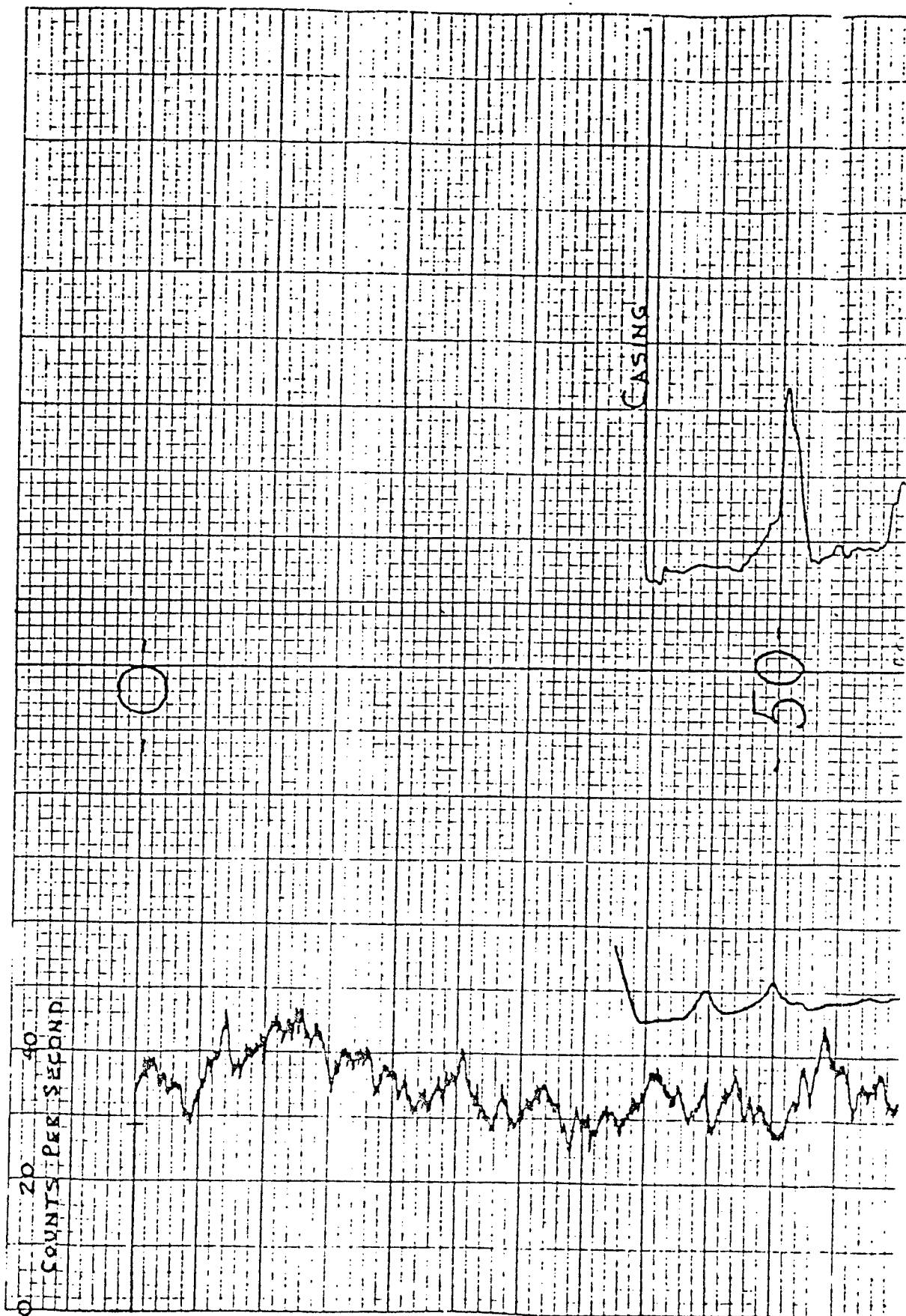
S.P.

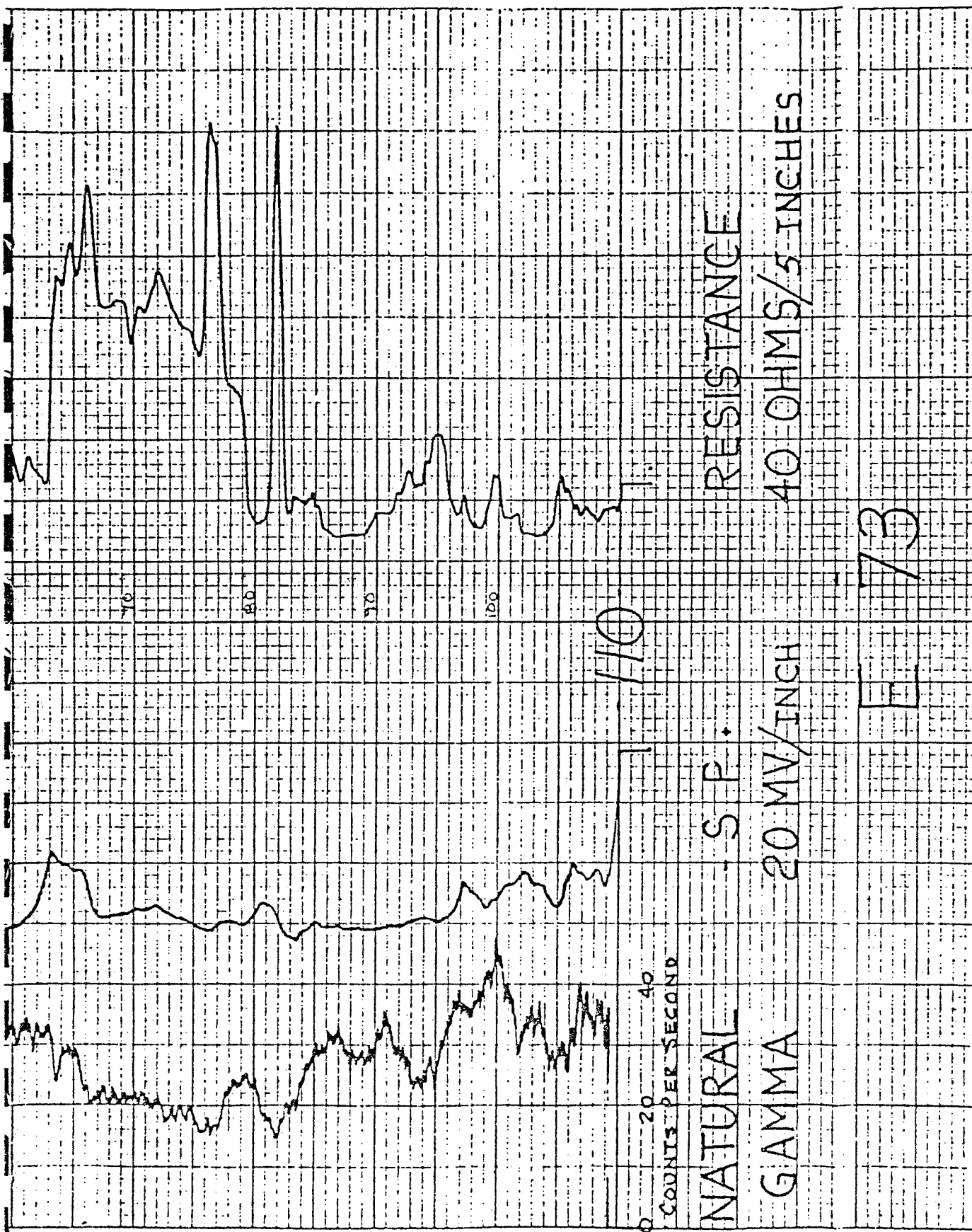
20 MV

RESISTANCE

40

OHMS/5 inches





WELL CONSTRUCTION SUMMARY

Borehole E-74A Well 37392
Project Name and Location _____ Project Number Task 39
Drilling Company Boyle Bros Driller Don Tryine Rig Number IR
Drilling Method(s) Auger Hollow Stem Auger 3/4" ID 7/4" OD continuous
Sample, reamed with 8 1/2" ID 12 3/4" OD Hollow Stem Auger
Borehole Diameter 12 1/4 in. _____ cm. 0.0 ft. _____ cm. to 30.2 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

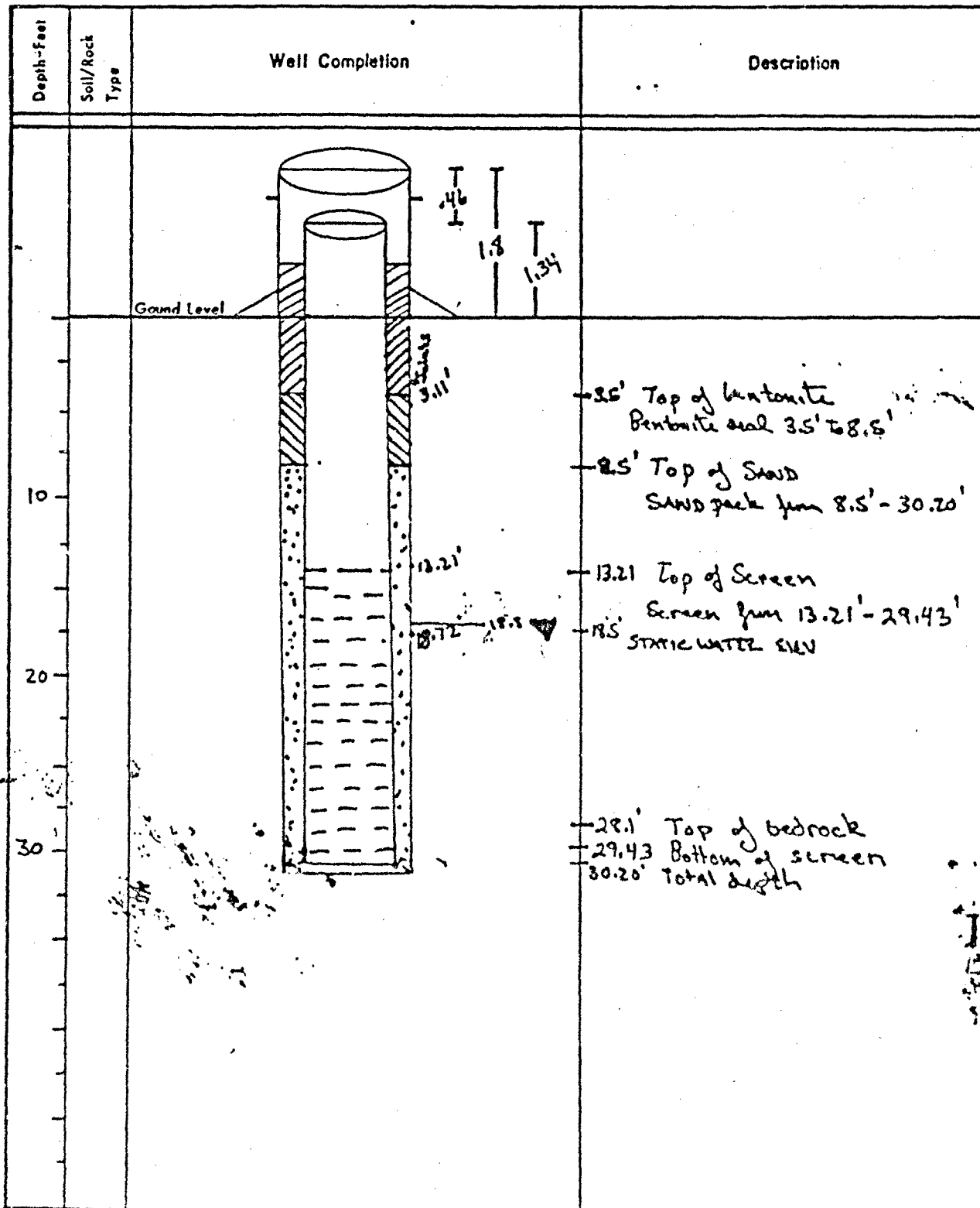
Size(s) and types of Bit(s) Hollow stem Auger 12 1/4 Sampling Method(s) continuous, split spoon
Size and Type PVC 4" sch. 40 0.20' slot Date/Time Start Drilling 7/2/87 1048
Total Borehole Depth 30.2 ft. _____ cm. Date/Time Finish Drilling 7/6/87 1556
Depth to Bedrock 28.1 ft. _____ cm. Date/Time Start Completion 7/7/87 0910
Depth to Water 18.5 ft. _____ cm. Date/Time Cement Protective Casing 7/7/87 0927
Water Level Determined By Sample Materials Used _____
Length Plain PVC (total) 14.91 ft. _____ cm. Plain PVC 1-10' section, 1-6' section
Length of Screen 16.22 ft. _____ cm. Slotted PVC 1-10' section, 1-5' section
Total Length of Well Casing 31.13 ft. _____ cm. Bentonite Pellets 4 1/2 buckets
PVC Stick Up 1.70 ft. _____ cm. Bentonite Granular 3/8 bag
Depth to Bottom of Screen 29.43 ft. _____ cm. Cement 3 bags
Depth to Top of Screen 13.21 ft. _____ cm. Sand 11 1/2 bags
Depth to Top of Sand 8.5 ft. _____ cm. Water added during completion none
Depth to Top of Bentonite 3.50 ft. _____ cm. Water added during drilling none
Total Gallons of water added _____

Drill Site Geologist Steve Pauls Date 7/9/87

Date/Time/Personnel Internal Mortar Cement Pad and Weep Hole Installed 07/13/87 / 1000 / am
Date/Time/Personnel Casing Painted (White) 07/13/87 / 1030 / am
Date/Time/Personnel Numbers Painted 7/13/87 JRT/IR
Materials Used 9 bags Sakrete

Top of Protective Casing to Top of PVC	<u>.46</u> ft. _____ cm.	COMMENT/NOTES
Top of Protective Casing to Weep Hole	<u>1.2</u> ft. _____ cm.	
Top of Protective Casing to Internal Mortar	<u>1.2</u> ft. _____ cm.	
Top of Protective Casing to Top of Cement Pad	<u>1.6</u> ft. _____ cm.	
Top of Protective Casing to Ground Level	<u>1.80</u> ft. _____ cm.	

Reviewed By _____ Date _____
Drill Site Geologist _____ Date _____

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY SUITE H-1
ENGLEWOOD, COLORADO 80112-3037 41-0829PAGE 2 OF 2Borehole: E-74AWell: 37392Drill Site Geologist: [Signature]Reviewed By: [Signature]Date: 7/13/87Date: 11/18/87

Borehole: E-74A

Well Number: 37392

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
1	1	0.0' - 2.0'			SM	Silty SAND, 35% silt, fine to coarse grained sand, 10YR 4/4, Dark yellowish brown, medium dense, moist, non plastic
2		100%			CL	Clay, 20% SAND, fine to coarse sand, 10YR 5/4, yellowish brown, stiff, moist, medium plastic, calcareous.
3	2	2.0' - 4.0'				
4		1.6' / 2.0'				Sand increases to 35%, fine to coarse grained
5	3	4.0' - 6.0'				
6		1.4' / 2.0'				
7	4	6.0' - 8.0'			SM	Silty SAND, 15% silt, fine to coarse grained sand, 10YR 6/4, light yellowish brown, med. dense, moist, non-plastic
8		1.7' / 2.0'				
9	5	8.0' - 10.0'			SC	Clayey SAND, 20% clay, fine to very coarse grained sand, 10YR 5/6, yellowish brown medium dense, moist, plastic.
10		1.4' / 2.0'				
6	6	10.0' - 12.0'			SM	Silty SAND, 15% silt, fine to coarse grained sand (from 10.5' to 10.8')

Drill Site Geologist: Steve Park

Date: 7/9/87

Reviewed By: Joseph L. Reed

Date: 9/29/87

215

Borehole: E-74A

Well Number: 37392

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11	6	10.0' - 12.0'			SM	2.5Y 6/6, Olive yellow, medium dense, moist, non plastic
12		1.8' / 2.0'			CL	CLAY, 30% Sand, fine to coarse grained sand, 2.5Y 5/4 - light olive brown, stiff, moist, medium plastic
13	7	12.0' - 14.0'			SC	SANDY CLAY, 20% CLAY, 10 YR 5/3, brown, medium dense, moist, brown, low plastic (fine to coarse grained sand)
14		1.8' / 2.0'				
15	8	14.0' - 16.0'			SP	Poorly graded sands, fine to coarse grained sands, 5% small gravel, 2.5Y 6/4, light yellowish brown, loose, moist, non plastic
16		100%				
17	9	16.0' - 18.0'			GP	Poorly graded gravel, fine to medium, 10YR 6/4, light yellowish brown, loose, moist, non plastic
18		2.0' / 2.0'			SP	Poorly graded sands, fine to very coarse grained, 10YR 7/2 light grey, loose, moist, non plastic
19	10	18.0' - 20.0'				sands saturated at 19.0'
20		2.0' / 2.0'				
21		20.0' - 22.0'				

Drill Site Geologist: Steve Papp

Date: 7/9/87

Reviewed By: Joseph L. Reed

Date: 7/29/87

Borehole: E-74A

Well Number: 37392

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
21 - 11	20.0' - 27.0'	0.0' / 2.0'			SP	Poorly graded sands, fine to very coarse grains 10YR 7/2, light grey, loose, ^{saturated} loose non plastic No recovery from 20.0' - 22.0' cuttings indicate poorly graded sands (SP)
22						
23 - 12	22.0' - 24.0'	3' / 2.0'			SP	No Recovery from 22.0' - 27.0' 24.0' Auger cuttings indicate poorly graded sands (SP) with possible silty sand lenses (SM)
24						Poorly graded sands (SP) from 22.0' - 24.0', fine to medium grained 10YR 7/2, light grey, loose, saturated, non plastic.
25						
26						
27						
28 - 14	27.0' - 29.0'	100% 2.0' / 2.0'		28.1'	SP	Poorly graded sands, fine to very coarse grained, 10% gravel, 10YR 7/2, light grey, loose, saturated, non-plastic CLAYSTONE BEDROCK, Olive, fe stains
29						TD 29.0'

Drill Site Geologist: Joseph H. Reed

Date: 7/13/87

Reviewed By: Joseph H. Reed

Date: 9/29/87

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7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112 • 303/741-0639PAGE 1 OF 1

BOREHOLE SUMMARY LOG

Borehole E-74 Well 37392
Project Name and Location MW Installation - N of RMA Project Number Task 39
Drilling Company Bayles Driller B. Roach Rig Number Failing 1500
Drilling Method(s) Rotary
Size(s) and type(s) of bit(s) 7 7/8", 3 3/4" bit
Borehole Diameter 7 7/8 in. 0 ft. 36 cm. to 111 ft. 111 cm.
3 3/4 in. 36 ft. 111 cm. to 111 ft. 111 cm.
Sampling Methods Continuous core
Total Number Soil Sampling Tubes —
Total Number Core Boxes —
Number of Gallons Lost Drilling Fluid —
Date/Time Started Drilling 7.2.87 0943
Date/Time Completed Drilling 7.7.87 0830
Total Borehole Depth 111 ft. — cm.
Depth to Bedrock 35 ft. — cm.
Depth to Water — ft. — cm.
Water Level Determined By? —
Borehole Completed as Monitoring Well? NO
Date/Time Grouting Completed 1410 7.7.87
Depth of Tremmie Pipe 110
Gallons of Grout 80 bags - 108
Materials Used 80 gals. water, 8 bags cement, 3/4 bag bentonite
Comments hole grouted to surface
Wellsite Geologist C. D. Benson Date 7.8.87
Checked for Grout Settlement on 11/18/87 by Steve Gurr
Amount of Grout Added none
All Measurements from Ground Level
Reviewed by Joseph L. Reed Date 11/18/87
Drill Site Geologist — Date —

ESE, Inc. CORE LOG

By CDB

Date 7-9-87

BORE E-74

Well(s)

Page 2 of 4

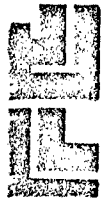
BOX no.	DEPTH Feet	U	S	Structure / Bedding		Hard- ness	Perm.		Mineralogy		Color	Texture / Grain Size clst sd gr mm	Lith. Char.	Lith. Class	Description / Comments
				Angle	Desc.		1°	2°	Min.	Habit					
						5	H	L	H	L	G	.01	LO	100	CM (Scale 1" = 2 ft)
	56				Massive				cln	frag.	2.5y		carbonaceous	CL	CLAYSTONE
	58								10%	mainly	4/10				
	60										very dark gray				
	62										5y		60"	CL	End of pervasive carbon Core recovery from uphole
	64										5/1				
	66								cln	5%	5y				
	68										4/10				
	70								Sand	15%	5y		60"		
	72								cln	10%	6/10		Sand zones areas discrete in claystone		
	74								cln	5%	frag.		71"	SS	SANDSTONE - SILTY

ESE, Inc. BORE E-74 WELL(S)

Box no.	DEPTH	Rec. Int.	Well(s)	Structure/Bedding		Hardness	Perm.		Mineralogy	Color	Texture/Gran. Size	Lith. Char.	Lith. Class	Description/Comments
				Angle	Desc.		1°	2°						
			U S			S H L	H L	H	Min. Habit	M G	clst ed gr mm 01 10 100		Fr	CM (Scale 1" = 7 ft)
	70				1/3 side				2 3/4 mudst. (grains to 1/4")	54 6/1 gray		silt 50% 75 1/2 70 silt 15%	SS CL SS	Silty sandstone claystone interbed
	78	1.5												
(4)	79	5												
	80													
	82													
	83	5												
	84	5												
	85													
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(5)	87	5												
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ESE, Inc. BORE E-74 WELL(S)

[illegible]



Frontier Logging

Lakewood, Colorado

Date JULY 7, 1987

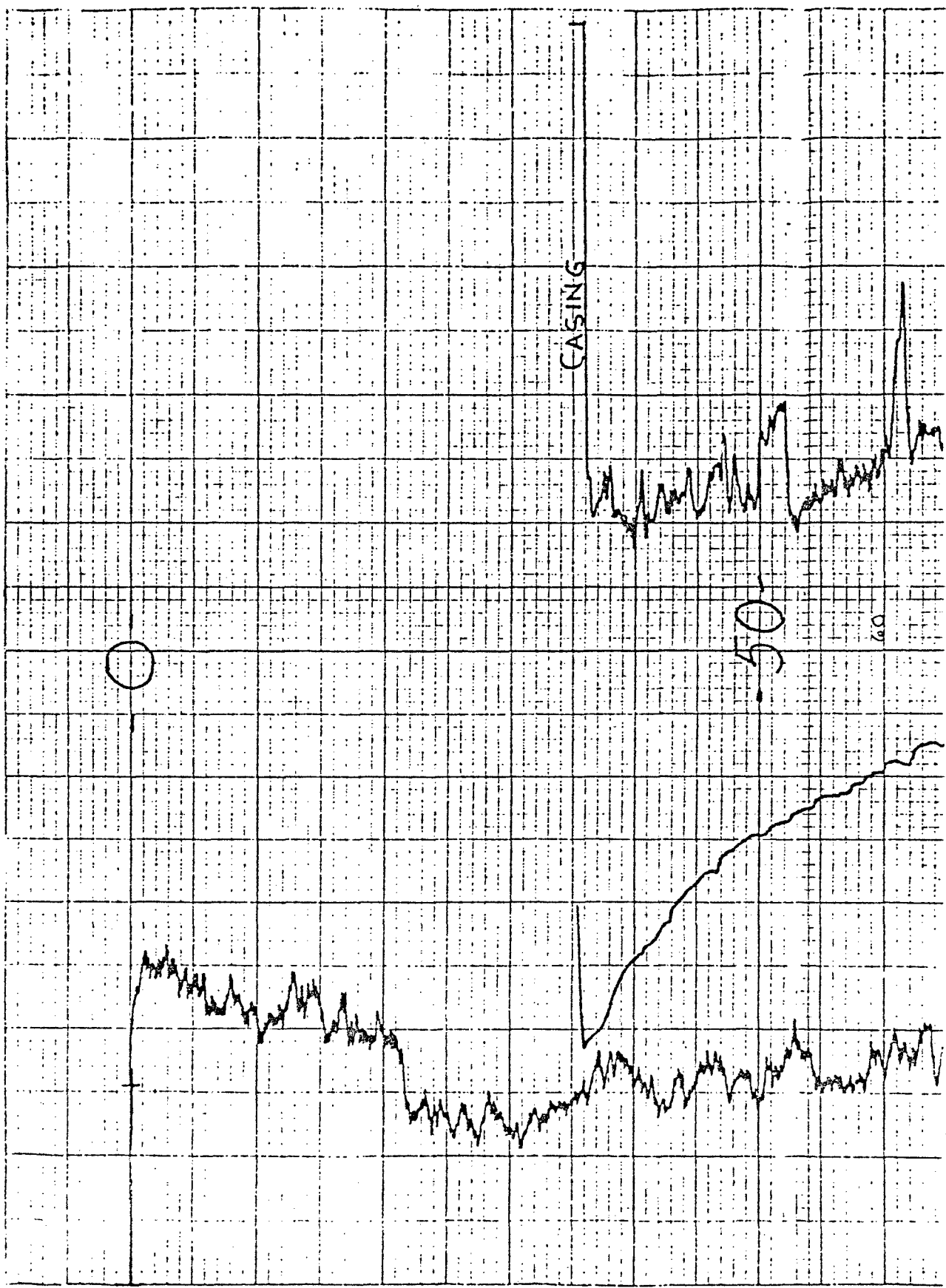
Property		Driller		Meters	
ESE		Depth 111 Ft		Round Trip	
E-74		3 7/8"		Sundry	
BMA		36 Ft		Time in 1145	
ADAMS COUNTY		water		Time out 1255	
Towns		Unit No. 110		Operator	
State Range		Km		Location	
COLORADO		Ground Level		Lakewood	
Log Measured From		Ground Level		Lakewood	
EQUIPMENT DATA		NATURAL GAMMA RANGES (ANALOG)		NATURAL GAMMA RANGES (ANALOG)	
D Logged		Scale		Scale	
104 FT		TC		TC	
200 Scale = 20		Logging Speed		Logging Speed	
2		From		From	
15		Total		Total	
103-1041		15/8		15/8	
Xtal 3/4 x 1"		7		7	
1.60 x 10 ⁻⁵		3 7/8"		3 7/8"	
1.10		25 cmw/5"		25 cmw/5"	
20 MU/Inch		20 MU/Inch		20 MU/Inch	
Resistance		Density Source No		Density Source No	
25 cmw/5"		Gamma (Analog)		Gamma (Analog)	
20 MU/Inch		Gamma (Digital)		Gamma (Digital)	
		Caliper		Caliper	
		Temperature		Temperature	
		Directional Data		Directional Data	
		Closure		Closure	
		Azimuth		Azimuth	
		True Vertical		True Vertical	
		Survey Depth		Survey Depth	

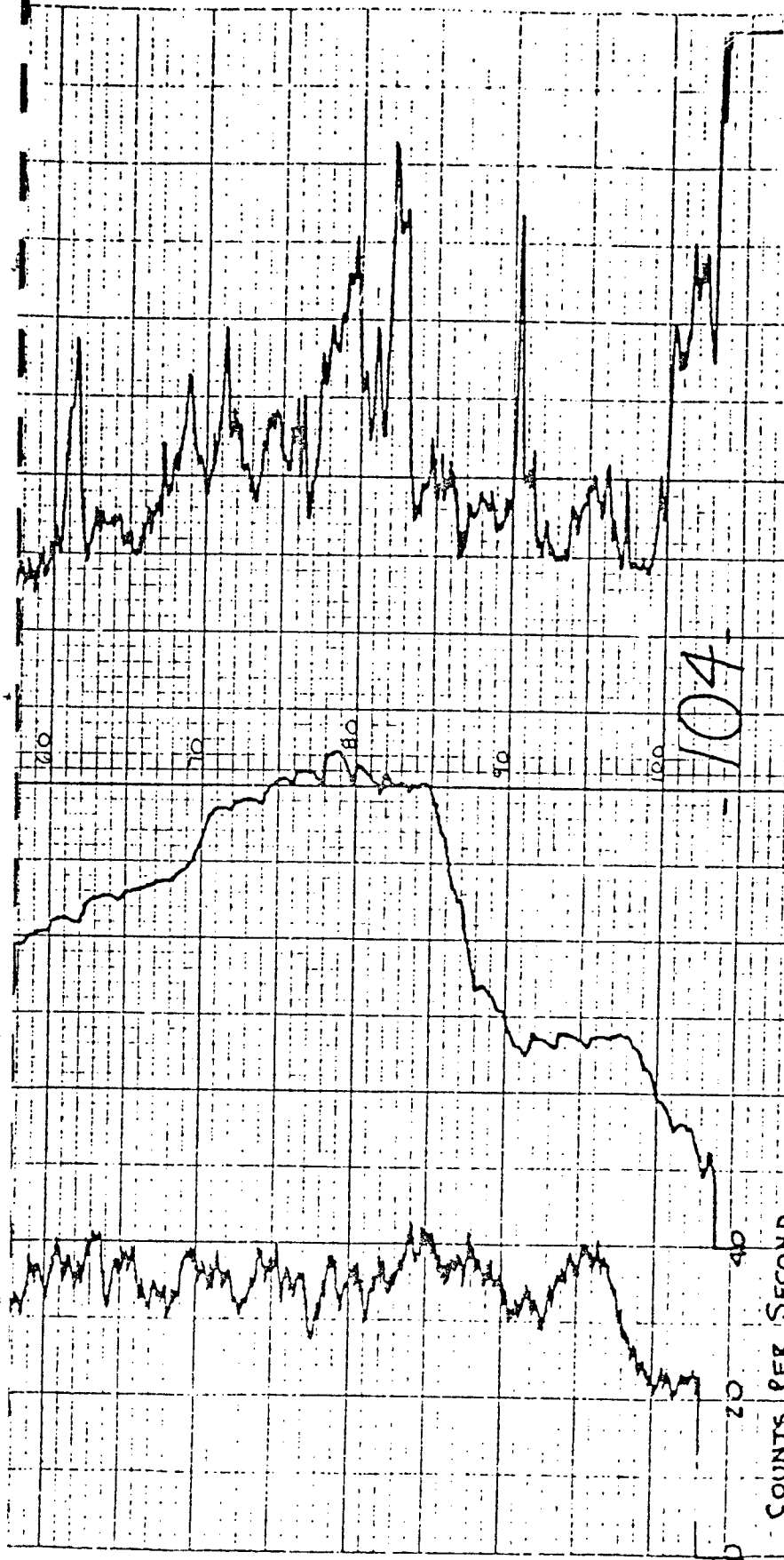
RESISTANCE

25

OHMS/ 5 inches

NATURAL GAMMA
 20 cps
 S.P.
 20 MV
 RESISTANCE
 25
 OHMS/5 inches





NATURAL
GAMMA

S P +
20 MV/INCH

RESISTANCE
25 OHMS/5 INCHES

104

F 7/4

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BOREHOLE SUMMARY LOG

JR
Borehole E-75A Well Dry Hole
Project Name and Location T-36 1/4 mile East Hwy 2, on 104th St Project Number 0053074.10
Drilling Company Boyle Bros Driller DAVE JACK Rig Number 6452
Drilling Method(s) Auger

Size(s) and type(s) of bit(s) _____
Borehole Diameter 2 1/4 in. _____ cm. _____ ft. _____ cm. to 48' ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Sampling Methods Continuous Split SpoonTotal Number Soil Sampling Tubes 24Total Number Core Boxes 5Number of Gallons Lost Drilling Fluid 0Date/Time Started Drilling 4/1/87 0830Date/Time Completed Drilling 4/1/87 1018Total Borehole Depth 48' ft. _____ cm.Depth to Bedrock 46' ft. _____ cm.Depth to Water Dry ft. _____ cm.Water Level Determined By? SamplesBorehole Completed as Monitoring Well? NODate/Time Grouting Completed 4-1-87 12:30Depth of Tremmie Pipe 10' AugerGallons of Grout ~135Materials Used 9 BAGS CEMENT 1 AUGER BIT

Comments During auger removal the auger caught up and not associated
with the core. Through sample analysis and ^{SPLIT} the hole was
degraded by. No well will be installed despite the heavy auger

Wellsite Geologist Greg LA Date 4/1/87Checked for Grout Settlement on 4/7/87 by JLRAmount of Grout Added 0.0

All Measurements from Ground Level

Reviewed by Joseph L. Reed Date 4/7/87

Drill Site Geologist _____ Date _____

Borehole: E-75A Well Number: Dry Hole

B.T. = 13.0'
PRC - 7/5/87

SOILS LOG
Description

MUNZELL COLARS

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	Description
0.0			NA		ML	ML sandy-silt, ~ 10% v.f. gr. sand, 10 YR, 4/2-3, lt. br., non-plas., loose, moist, alluvium.
1.0	0-2'	2'		0-2'		
1.5						
2.0						At 1.8', sandy-silt, ~ 10% v.f. gr. sand, 10 YR, 7/3-4, v. pale br., non-plas., med. dense, dry, alluvium.
3.0	2-4'	2'		2-4'		
4.0						
5.0	4-6'	2'		4-6'		
6.0						At 6.0' sandy-silt, ~ 30-40% v.f. gr. sand, 10 YR, 5/4-6, ywsh br., non-plas., loose, moist, alluvium.
7.0	6-8'	2'		6-8'		
8.0						
9.0	8-10'	2'		8-10'		
9.5						
10.0	10-12'	2'		10-12'		At 9.5' clayey-silt, ~ 20% clay, 10-15% v.f. gr. sand, 10 YR, 5/3-4, br., slightly plas., moist, alluvium.
11.0						

Drill Site Geologist: A.E. Dittell Date: 4/8/87
Reviewed By: Joseph L. Reed Date: 8/16/87

Borehole: E-75A

Well Number: Dry Hole

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
						Munsell Colors
11.0	10-12'	2'	NA	10-12'	ML	
12.0	12-14'	2'		12-14'		
13.0	14-16'	2'		14-16'	CL	CL sandy-clay, 10-20% v.f. gr sand, 10% 6/2-3, light. brnsh. grey, low plas., med. stiff, moist, alluvium Bedrock 200
14.0	16-18'	2'		16-18'		At 15.0' silty-clay, 10-20% silt, 5-10% v.f. gr sand, 10% 6/1-2, grey, med. plas., med. stiff, moist, alluvium. Bedrock 200
15.0	18-20'	2'		18-20'		
16.0	20-22'	2'		20-22'	ML	ML sandy-siltst, 10-20% v.f. gr sand, 10% 6/6-8, grey. brn., no plas., loose, moist, alluvium. med dark, Bedrock 200
17.0						
18.0						
19.0						
20.0						
21.0						
22.0						

Drill Site Geologist: Dr. Estelle

Date: 4/9/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

Borehole: E-75A

Well Number: Dry Hole

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
						<u>Munsell Colors</u>
22.0			<u>NA</u>		<u>ML</u>	
23.0	22-24'	2'		22-24'		
24.0						
25.0	24-26'	2'		24-26'		
26.0					<u>SM</u>	
27.0	26-28'	2'		26-28'		<u>SM</u> silty-sand, ~ 20-30% silt, 2.5 Y, 6/4, lgt. green, non-pls., loose, moist, alluvium. Bedrock DRC
28.0						
29.0	28-30'	1.4'		28-30'		
30.0						
31.0	30-32'	2'		30-32'		At 31.0', silty-sand, ~ 10-15% silt, 2.5 Y, 5/4, lgt. olive brn., non-pls., dense, moist, alluvium. Bedrock DRC
32.0	32-34'	2'		32-34'		

Drift Site Geologist: A.E. Entick
Reviewed By: Joseph L. Reed

Date: 4/3/87
Date: 4/16/87

Borehole: E-75A

Well Number: Dry Hole

SOILS LOG						Description
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
MUNSELL Colors						
33.0	32-34'	2'	NA	32-34'	SM	
34.0	34-36'			34-36'		
35.0	36-38'	2'		36-38'		
36.0	38-40'	2'		38-40'	ML	
37.0	40-42'	1.3'		40-42'		<u>ML</u> sandy-siltst., ~10-20% v.f. gr. sand, 2.5Y, 5/2, graysh. brn., non-pls., dense, moist, alluvium Recover PRL
38.0	42-44'	2'		42-44'	SM	
39.0						At 400' sandy-siltst., ~10-20% v.f. gr. sand, 2.5Y, 6/1, light graysh. brn., non-pls., med. dense, slightly moist, alluvium Recover PRL
40.0						
41.0						
42.0						

Drill Site Geologist: S.E. Entley
Reviewed By: Joseph L. Reed

Date: 4/8/87

Date: 4/16/87

22

Borehole: E-75A

Well Number: Dry Hole

SOILS LOG						Description
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
44.0			NA		SM	Munsell Colors
45.0	44-46'	2'		44-46'		
45.5						
46.0					CL	CL silty - clayst., 5-10% silt, 2.54, 4/1, dk gray brownish plas., stiff, slightly moist, bedrock.
47.0	46-48'	1.5'		46-48'		
48.0						END OF BORING LOG
49.0						
50.0						
51.0						
52.0						
53.0						
54.0						
55.0						
56.0						

Drill Site Geologist: A.E. Dittler

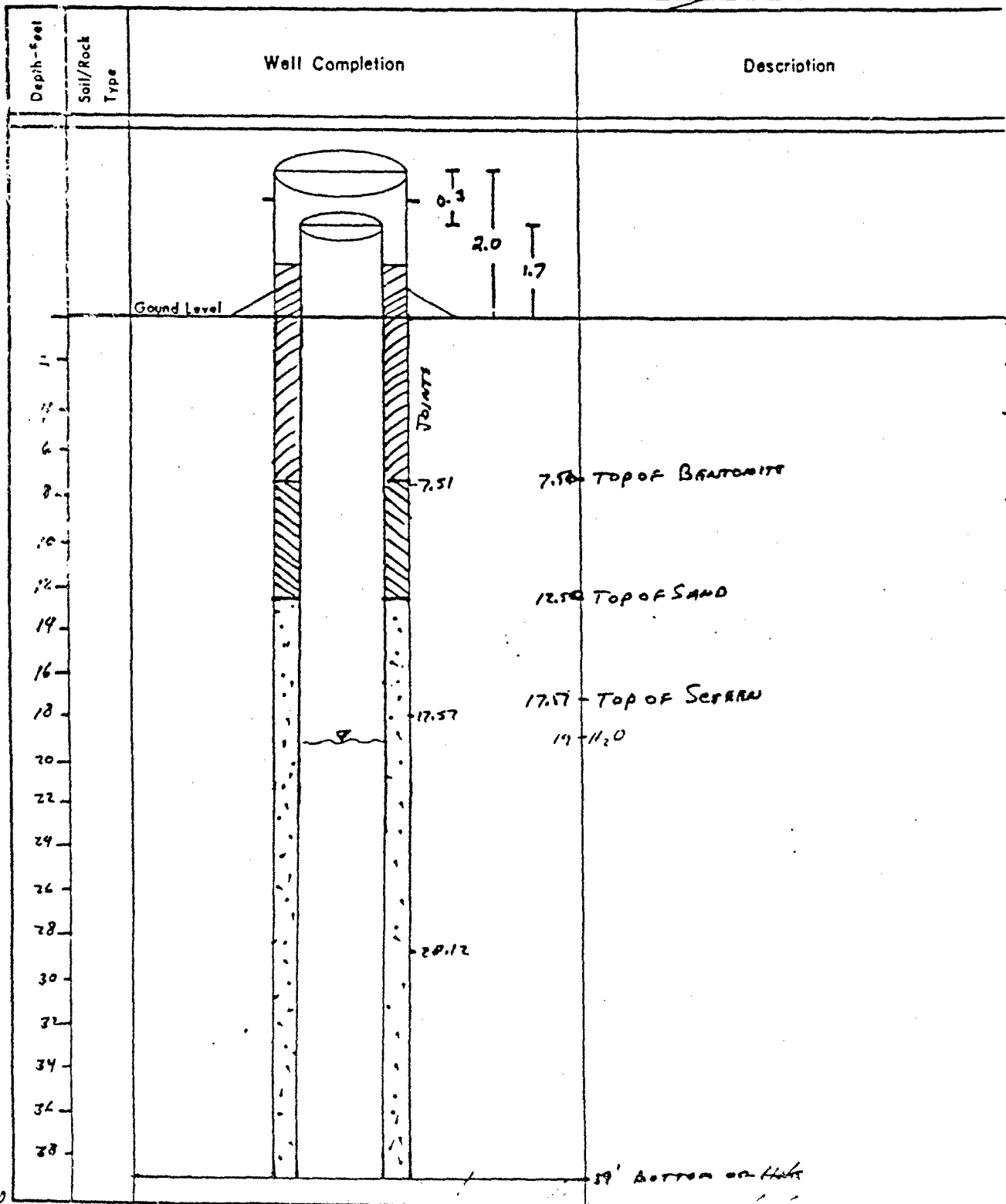
Date: 4/8/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

Borehole: E-76A

Well: 3R
E76A 37383



Drill Site Geologist: [Signature]
Reviewed By: Joseph A. Reed

Date: 6/10/87
Date: 4/20/87

WELL CONSTRUCTION SUMMARY

Borehole E-76A Well JR E76A 37383
Project Name and Location Task 26 1/2 mile E of Hwy 2 on 104th Project Number 17053072.10
Drilling Company Boylis Bros Driller Dave Jarvis Rig Number 5952
Drilling Method(s) Huger

Borehole Diameter 12 1/4 in. _____ cm. _____ ft. _____ cm. to 39 ft. _____ cm.
_____ in. _____ cm. _____ ft. _____ cm. to _____ ft. _____ cm.

Size(s) and types of Bit(s) _____

Size and Type PVC 4"

Total Borehole Depth 37 ft. _____ cm.

Depth to Bedrock ~38 ft. _____ cm.

Depth to Water 19 ft. _____ cm.

Water Level Determined By SAMPLES

Length Plain PVC (total) 19.37 ft. _____ cm.

Length of Screen 36.43 ft. _____ cm.

Total Length of Well Casing 40.7 ft. _____ cm.

PVC Stick Up 1.7 ft. _____ cm.

Depth to Bottom of Screen 39.0 ft. _____ cm.

Depth to Top of Screen 12.57 ft. _____ cm.

Depth to Top of Sand 12.5 ft. _____ cm.

Depth to Top of Bentonite 2.5 ft. _____ cm.

Sampling Method(s) Continuous Split Spoon

Date/Time Start Drilling 4/13/87 10/56

Date/Time Finish Drilling 4/13/87 1030 including

Date/Time Start Completion 4/13/87 1030

Date/Time Cement Protective Casing 4/13/87 1200

Materials Used 21-2' TUBES

Plain PVC 2-10' SECTIONS

Slotted PVC 2-10' SECTIONS

Bentonite Pellets 5 BUCKETS

Bentonite Granular _____

Cement 3 BAGS

Sand 16 BAGS

Water added during completion 25

Water added during drilling 5

Total Gallons of water added 30

Drill Site Geologist Greg L. Luth

Date 4/13/87

Date/Time/Personnel Internal Mortar, Cement Pad, and Weep Hole Installed 4-13-87/900/12 Pichro, m. m. m.

Date/Time/Personnel Casing Painted 14 4/13/87 1100 PSR

Date/Time/Personnel Numbers Painted 2/17/87 1040 PTB

Materials Used 12 bags Quikrete 1/2 bag silica sand 1/4 bag portland cement

Top of Protective Casing to Top of PVC 0.3 ft. _____ cm. COMMENT/NOTES

Top of Protective Casing to Weep Hole 0.9 ft. _____ cm.

Top of Protective Casing to Internal Mortar 0.55 ft. _____ cm.

Top of Protective Casing to Top of Cement Pad 0.53 ft. _____ cm.

Top of Protective Casing to Ground Level 2.0 ft. _____ cm.

Reviewed By Joseph L. Reed Date 4/20/87

Drill Site Geologist Greg Luth Date 6/10/87 226

Borehole: E-76A

Well Number: 37383

5121.05

SOILS LOG						Description
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
0.0						<u>MUSSELL</u> <u>Colors</u>
0.0 - 1.0	0-2'	2'	NA	0-2'	ML	ML sandy-silt, ~2.0% v.f. gr. sand, 10 YR, 4/3-4, dk br., non-pls., loose, moist, alluvium.
1.0 - 2.0						At 1.5', sandy-silt, ~2.0% v.f. gr. sand, color changes to 10 YR, 5/6-8, ywash. br., non-pls., loose, moist, alluvium.
2.0 - 3.0	2-4'	2'		2-4'		
3.0 - 4.0						
4.0 - 5.0	4-6'	2'		4-6'		
5.0 - 6.0						
6.0 - 7.0	6-8'	2'		6-8'		At 7.0', sandy-silt, percent sand increases to 4.0% v.f. gr. sand, 10 YR, 5/6-8, ywash. br., non-pls., loose, moist, alluvium.
7.0 - 8.0						
8.0 - 9.0	8-10'	2'		8-10'		
9.0 - 10.0						
10.0 - 11.0	10-12'	2'		10-12'	SM	SM silty-sand, ~4.0% silt, 10 YR, 5/6-8, ywash br., non-pls., loose, moist, alluvium.
11.0 - 12.0						

Log
Drill Site Geologist: A.E. Jantke
Reviewed By: Joseph L. Reed

Date: 4/8/87

Date: 4/16/87

Borehole: E-76A

Well Number: 37383

SOILS LOG						Description
Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
MUNSEE Colors						
11.0	10-12'	2'	NA	10-12'	SM	At 11.0', percent silty-sand, percent of silt decreases to ~ 20% silt, 10 YR, 6/6, brownish yellow, non-pls., loose, moist, alluvium.
12.0	12-14'			12-14'		
13.0	14-16'	2'		14-16'		
14.0	16-18'			16-18'		At 14.5', silty-sand, percent silt decreases to 5-10% silt, 10 YR, 6/6, brownish yellow, non-pls., loose, moist, alluvium.
15.0	18-20'	2'		18-20'		
16.0	20-22'			20-22'		
17.0						At 19.0', silty-sand, 10% silt, 70% med-coarse gr. sand., 10 YR, 5/6-8, yellowish brn., non-pls., loose, saturated, alluvium.
18.0						
19.0						
20.0						
21.0						
22.0						

Drill Site Geologist: Lee Osteltz

Date: 4/8/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

Borehole: E-76A

Well Number: 37383

SOILS LOG						Description
Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	
22.0					SM	<i>Munsell Colors</i>
23.0	22-24'	2'		22-24'		
24.0				24-26'		
25.0	24-26'	1.5'		26-28'		
26.0				28-30'		
27.0	26-28'	1.0'		30-32'		
28.0				32-35'		
29.0	28-30'	2'				
30.0						
31.0	30-32'	1.5'			SP	
32.0						SP gravelly-sand, 10-20% gte. gravel, 10 yr. 5/6-8, ywash. brn., non-pls, loose, saturated, alluvium.
33.0	32-35'	2'				

Drill Site Geologist: L.B. [Signature]
Reviewed By: Joseph L. Reed

Date: 4/8/87

Date: 4/16/87

24.0

Borehole: E-76A

Well Number: 37383

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
33.0			NA		SP	
34.0	33-35'	2'		33-35'		
35.0						
36.0	35-37'	0'		35-37'		No Recovery - SAMPLE LOST
37.0						
38.0	37-38'	1'		37-38'	SP	
39.0						
40.0	38-40'			38-40'	OL Ch	OL, clayey, 20-30% clay, 10 YR, 4/4-6, dk. ywd brn., low-pls., v. dense, wet, bedrock.
41.0	40-41'			40-41'		
42.0						END OF BORING LOG
43.0						
44.0						

Drill Site Geologist: Joseph L. Reed

Date: 4/8/87

Reviewed By: Joseph L. Reed

Date: 4/16/87

APPENDIX C
WELL LOCATIONS, COMPLETION DATA AND SITE CONDITIONS, AND SITING RATIONALE

C-1 ALLUVIAL WELLS

Alluvial Wells

Site E-38, Well 37374

Location: Site E-38 is located approximately 800 ft north of the south section line and 900 ft east of the west section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: A borehole was drilled to a total depth of 26.5 ft where silty claystone bedrock was encountered at 26.0 ft. During drilling, the water table was estimated to be at 10 ft below ground surface. Well 37374 was screened across the entire saturated thickness in predominantly silty sand material.

Siting Rationale: This installation is a cluster site which is being utilized to examine the potential for flow between the alluvium and Denver Fm aquifers and water chemistry within both aquifers. The alluvial well was installed to assess water quality and water levels in the southwest corner of Section 14. In this area, the alluvial aquifer appears to be separated from the main alluvial pathway along First Creek by a zone of unsaturated alluvium. This well is downgradient of the western portion of the NBCS and is being used to depict the water chemistry and hydrogeology along this flow pathway.

Site E-39

Location: Site E-39 is located approximately 880 ft north of the south section line and 2630 ft east of the west section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: The borehole at this site was drilled to 20.0 ft and the bedrock contact was called at 18 ft. The alluvium, which consists mostly of silty sands and clayey sands was unsaturated at this site and therefore no alluvial well was completed. The water table was encountered in the sandy claystone bedrock and was estimated to be at 19 ft below ground surface.

Siting Rationale: This alluvial well was to be part of a cluster site. However, unsaturated alluvium was encountered. Therefore, geologic data was obtained from continuous logging and the hole was abandoned in accordance with Section 3.4 of the Task 36 Technical Plan. Data obtained from this site helps to delineate the bedrock surface and a zone of unsaturated alluvium in the southern portion of Section 14.

Site E-40, Well 37370

Location: Site E-40 is located approximately 1280 ft north of the south section line and 1875 ft west of the east section line of Section 14 (T2S, R67W).

6/14/88

Completion Data and Site Conditions: The borehole at this site encountered water at 9 ft and the bedrock contact was estimated at 26 ft. Well 37370 was screened across the water table to the bedrock contact. The bedrock encountered at the bottom of the boring is a dark brown weathered claystone.

Siting Rationale: The alluvial well at this site is part of a cluster installation being used to assess water chemistry and the potential for vertical flow between the alluvium and Denver Fm aquifers. The alluvial well at this site was installed to further define the hydrogeology and water chemistry along the First Creek paleochannel which has historically shown significant contaminant concentrations.

Site E-42, Well 37369

Location: Site E-42 is located approximately 750 ft north of the south section line and 440 ft west of the east section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: A borehole was drilled to an approximate depth of 26 ft where claystone bedrock was encountered. During drilling the water table was estimated to be 5 ft below ground surface. Well 37369 is screened across the water table to the bedrock contact in well graded gravelly sands.

Siting Rationale: This alluvial well was installed to fill a data gap in the monitoring network just downgradient of the NBCS. This site is fundamental to the monitoring program because it depicts the hydrogeology and water chemistry along the First Creek paleochannel just west of Peoria Street where there are currently no alluvial monitoring sites. This area is suspected of significant alluvial ground water contamination because of high concentrations upgradient along the paleochannel.

Site E-44, Well 37373, Well 37398, Well 37399

Location: Site E-44 is located approximately 1950 ft north of the south section line and 1780 ft west of the east section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: The borehole at the site of Well 37373 was drilled to a total depth of 26 ft. Weathered claystone bedrock was encountered at 25.0 ft. Depth to water was estimated to be at 3.5 ft below ground surface during drilling. Alluvial borings were also drilled for Wells 37398 and 37399. At Well 37398, the boring was drilled to a total depth of 25.0 ft and weathered claystone bedrock was encountered at 23.7 ft. Depth to water was estimated at 2.2 ft below ground surface during drilling. At Well 37399, the boring was drilled to a total depth of 24.0 ft and silty sandstone bedrock was encountered at 22.8 ft. Depth to water was estimated to be at 2.4 ft below ground surface during drilling. All three wells are screened across the

C.2 DENVER WELLS

Denver Wells

Site E-34 Pilot Corehole Well #37376 D1

Location: Site E-34 is located approximately 50 ft north of the south section line and 2575 ft east of the west section line of Section 13 (T2S R67W).

Completion Data and Site Conditions: Two Denver Fm sandstone units were encountered during drilling of the 55 ft pilot corehole. A 10 ft claystone aquitard separates the alluvium from the first sandstone unit. The two saturated sandstones are separated by only a 2-ft fractured lignitic claystone, therefore they are assumed to be hydrologically connected and Well 37376 is completed in both sandstones.

Siting Rationale: The pilot corehole at this site was drilled to provide geologic data for cross sections and a well completion. Well 37376 was installed to obtain hydrologic and water quality data in the first and second Denver Fm sandstone units downgradient of the NBCS. There are currently no first or second Denver sandstone water quality wells in service in this area. Water quality data is needed here to assess if these Denver Fm units are acting as contamination pathways beneath the NBCS.

Site E-38 Pilot Corehole Well 37379 D1 Well 37380 D2

Location: Site E-38 is located approximately 850 ft north of the south section line and 900 ft east of the west section line of Section 14 (T2S, R67W).

Completion Data and Site Conditions: The 130 ft pilot corehole was drilled and four Denver Fm sandstone units were encountered. The alluvium is separated from the first sandstone by a 15.5-ft claystone aquitard and a 7-ft silty claystone interval. Upon review of the corehole data Well 37379 was completed in the first saturated sandstone and Well 37380 was completed in the second saturated sandstone. Wells may need to be completed in the deeper sandstones if the chemical analyses on Well 37380 show it to be contaminated.

Siting Rationale: The pilot corehole at this site was drilled to provide geologic data for cross sections and well completions. This corehole will also provide geologic data for any future interpretive work in the Denver Fm and/or any future well installations at this site. Wells 37379 and 37380 were installed to provide hydrologic and water quality data for the first and second Denver Fm sandstone units northwest of the NBCS. This well cluster will fill a large data gap that exists in the southwest corner of Section 14.

Site E-39, Pilot Corehole, Well 37387 D1, Well 37388 D2

Location: Site E-39 is located approximately 900 ft north of the south section line and 2620 ft west of the east section line of Section 14 (T2S R67W).

Completion Data and Site Conditions: The pilot corehole was drilled to a total depth of 130 ft and six Denver Fm sandstone units were encountered. The bedrock lithology is a claystone and this creates the 9-ft thick aquitard between the alluvium and the first Denver sandstone unit. Review of the pilot corehole data showed that this site is located on a bedrock high and the first sandstone unit is not correlated to sandstones in surrounding wells. Therefore, it is not likely that this hydrologic unit is contaminated and a well was not completed in this interval. Well 37387 was completed in the second saturated sandstone and Well 37388 was completed in the fourth saturated sandstone which correlated with the previously installed Denver wells.

Siting Rationale: The pilot corehole at this site was drilled to provide important geologic data for cross sections that will aid in the assessment of the lateral and northerly extent of the Denver Fm sandstone units and for the completion of Wells 37387 and 37388. This corehole will also provide geologic data for any future interpretive work in the Denver Fm and/or any future well installations at this site. There are presently no first or second Denver Fm sandstone wells in this area and monitoring wells in these sandstone units are required to assess the water quality of the Denver Fm sandstones downgradient of the barrier at this location.

Site E-40, Pilot Corehole, Well 37371 D1, Well 37372 D2

Location: Site E-40 is located approximately 1300 ft north of the south section line and 1880 ft west of the east section line of Section 14 (T2S R67W).

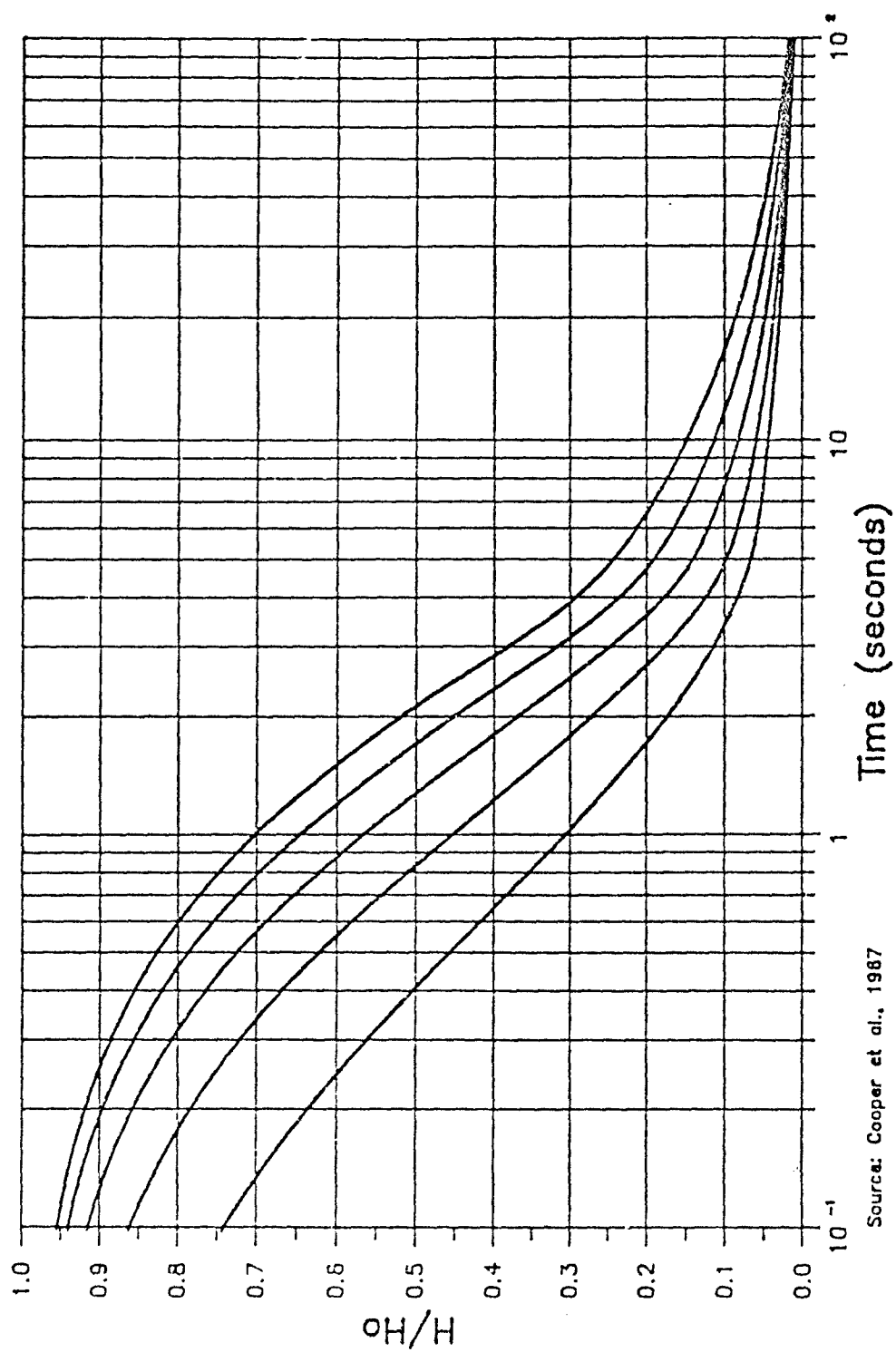
Completion Data and Site Conditions: The pilot corehole was drilled to an approximate total depth of 96.5 ft and three sandstones were encountered. A 4-ft clayey siltstone separates the alluvium from the first Denver sandstone and therefore it appears that this first sandstone is 2-ft hydrologically connected with the alluvium. Well 37371 is screened entirely within the first saturated sandstone. The lower sandstones are interbedded with siltstone and claystone and the pilot corehole log showed no substantial confining claystone layer between the sandstones. Therefore, the sandstones were assumed to be hydrologically connected and Well 37372 screens them as one unit.

Siting Rationale: The pilot corehole at this site was drilled to provide geologic data downgradient of the NBCS for cross sections and well completions. This corehole will also provide geologic data for any future interpretive work in the Denver Fm and/or any future well installations at this site. The Denver Fm wells are a part of a cluster site being used to assess the potential for vertical flow.

APPENDIX D
SLUG TESTS: COOPER TYPE CURVES AND DATA CURVES,
AND AQUIFER TEST ANALYSES

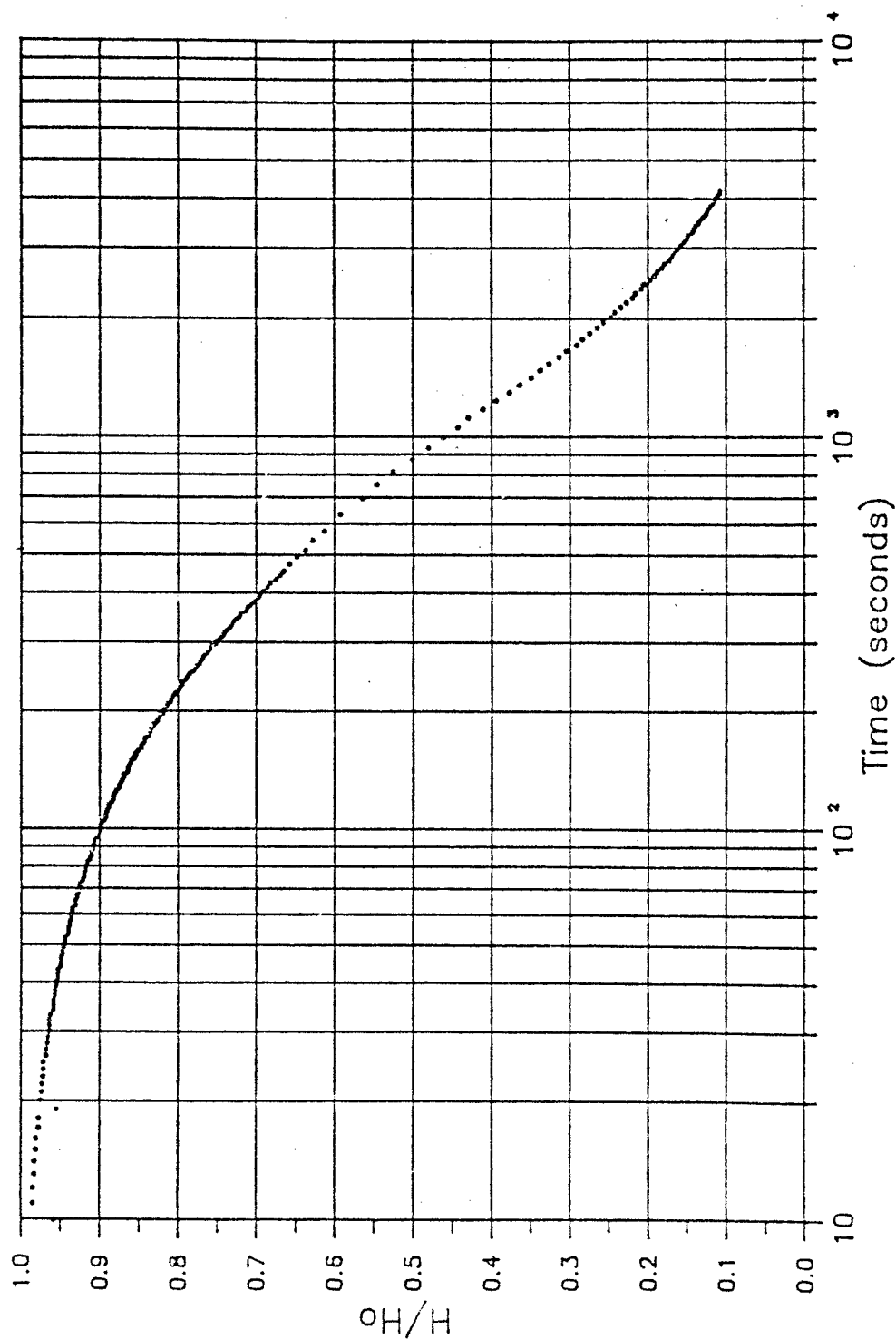
D.1 SLUG TESTS; COOPER TYPE CURVES AND DATA CURVES

TYPE CURVES



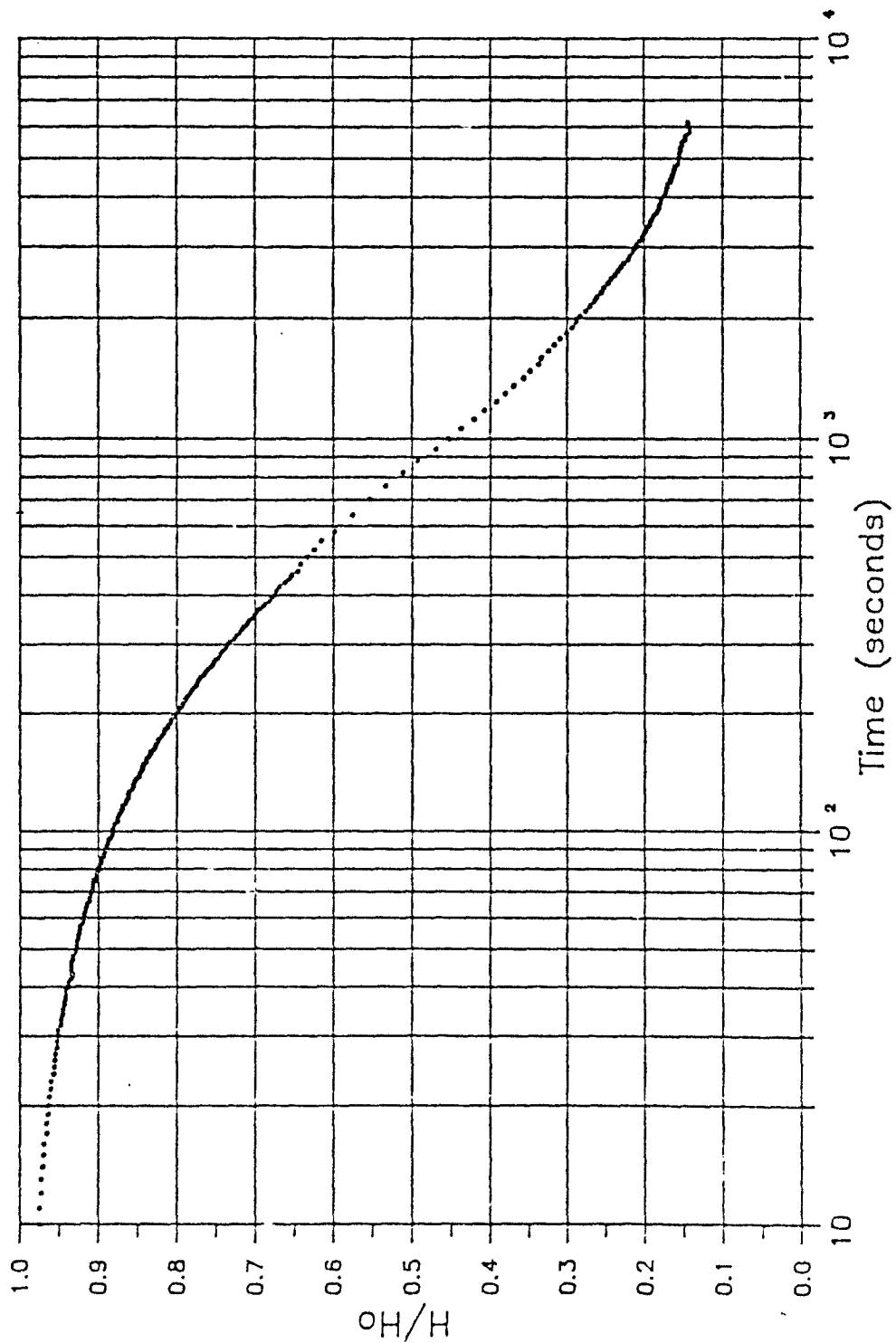
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Slug In



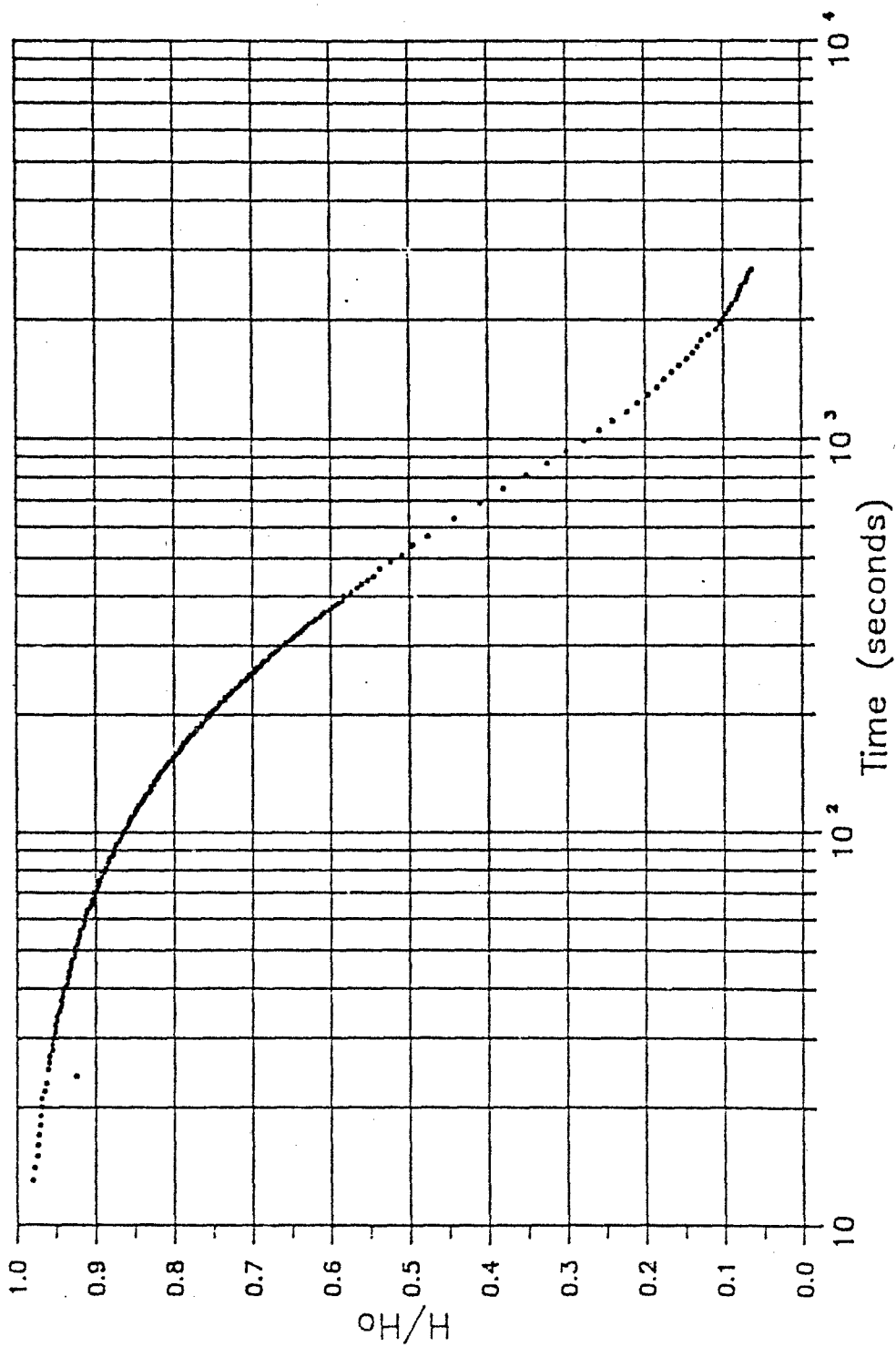
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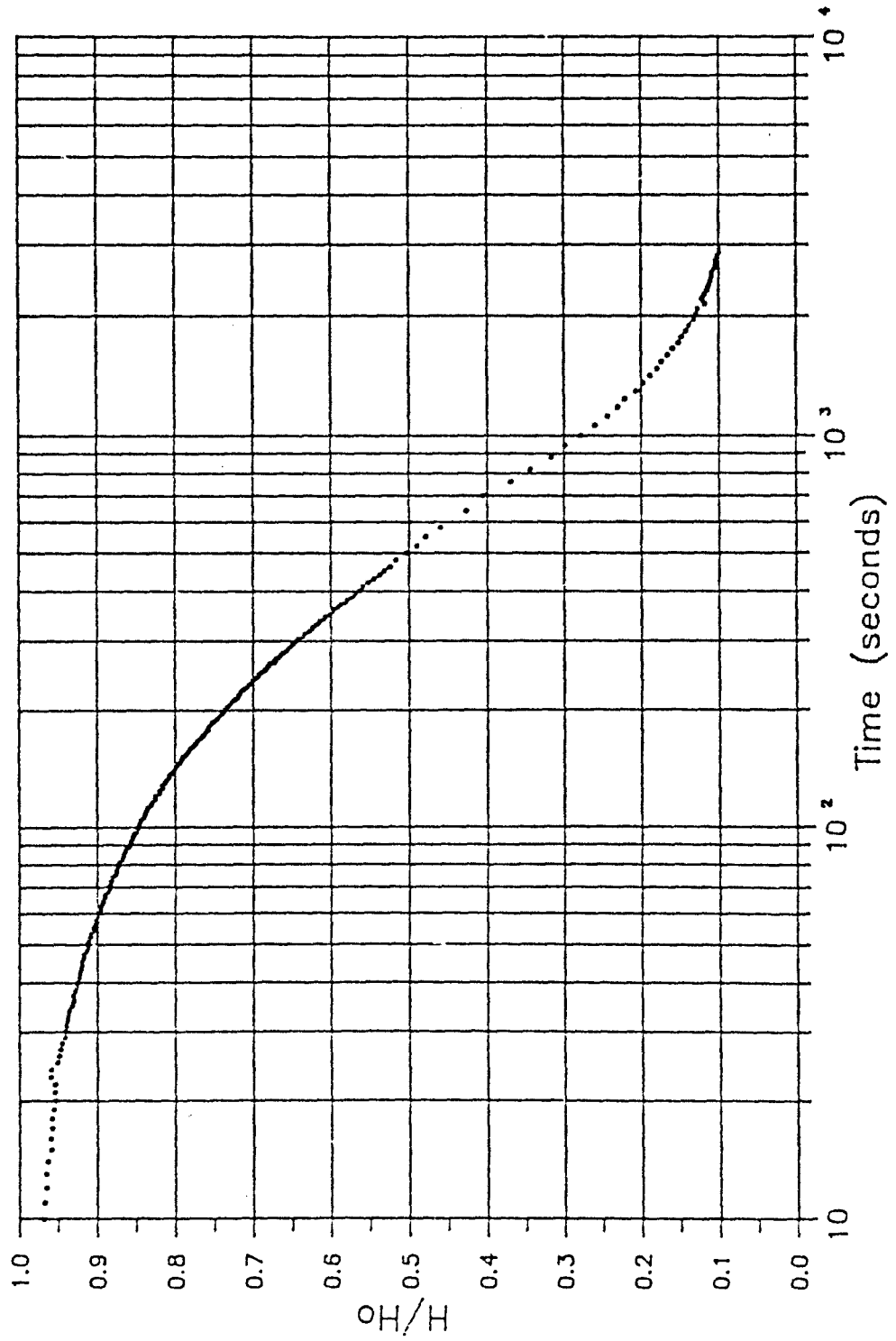


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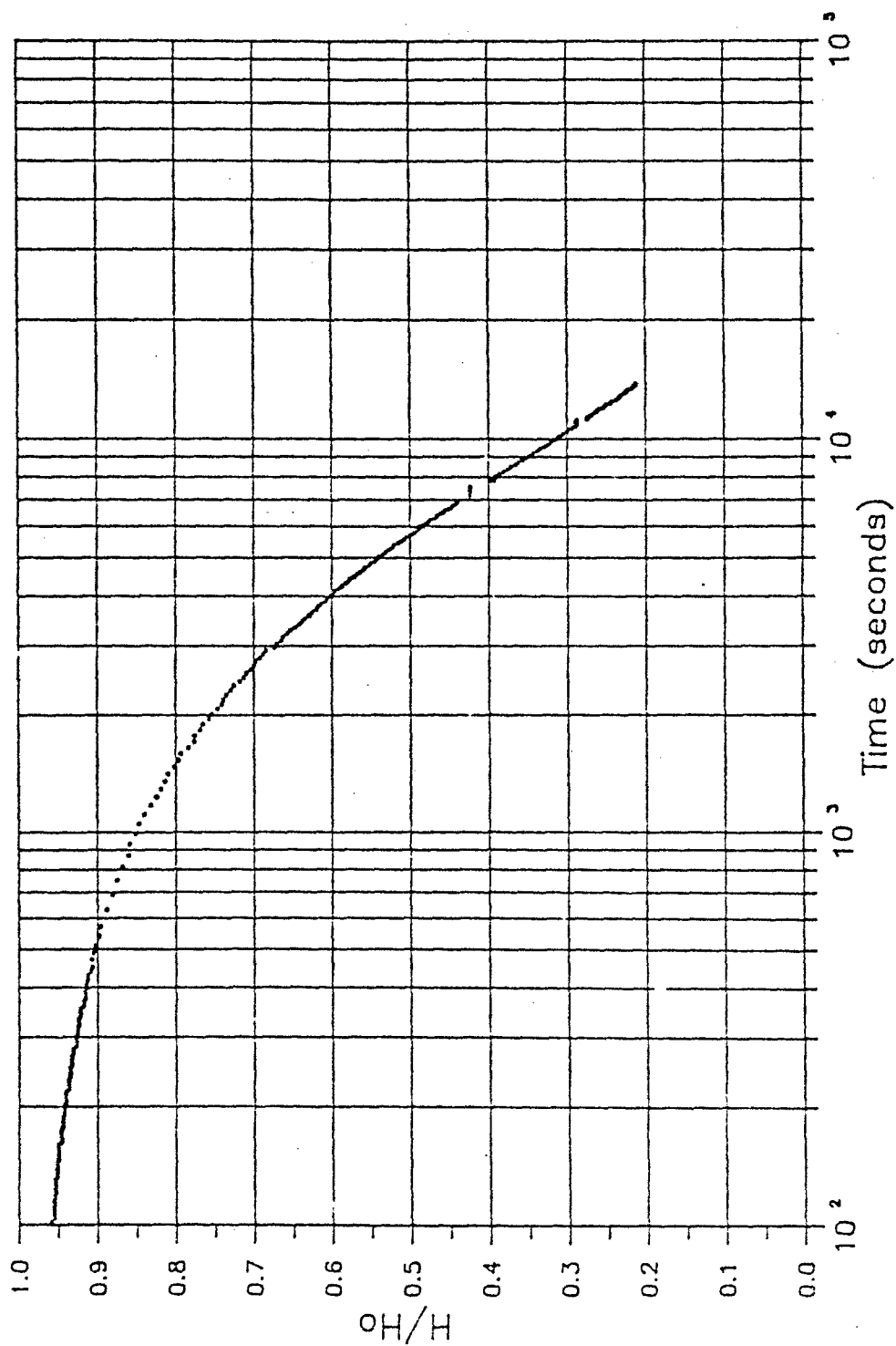


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Slug Out

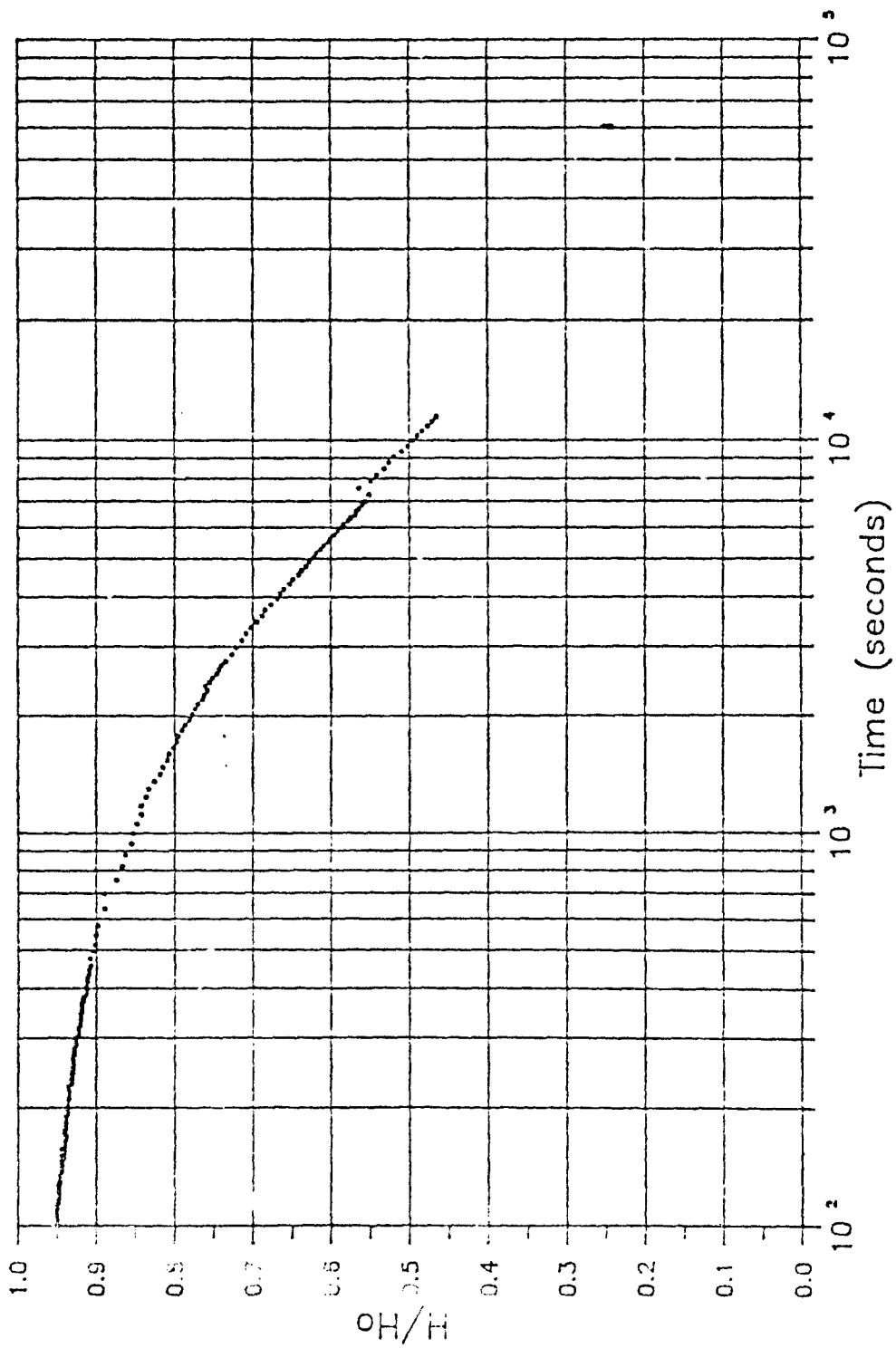


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Slug In

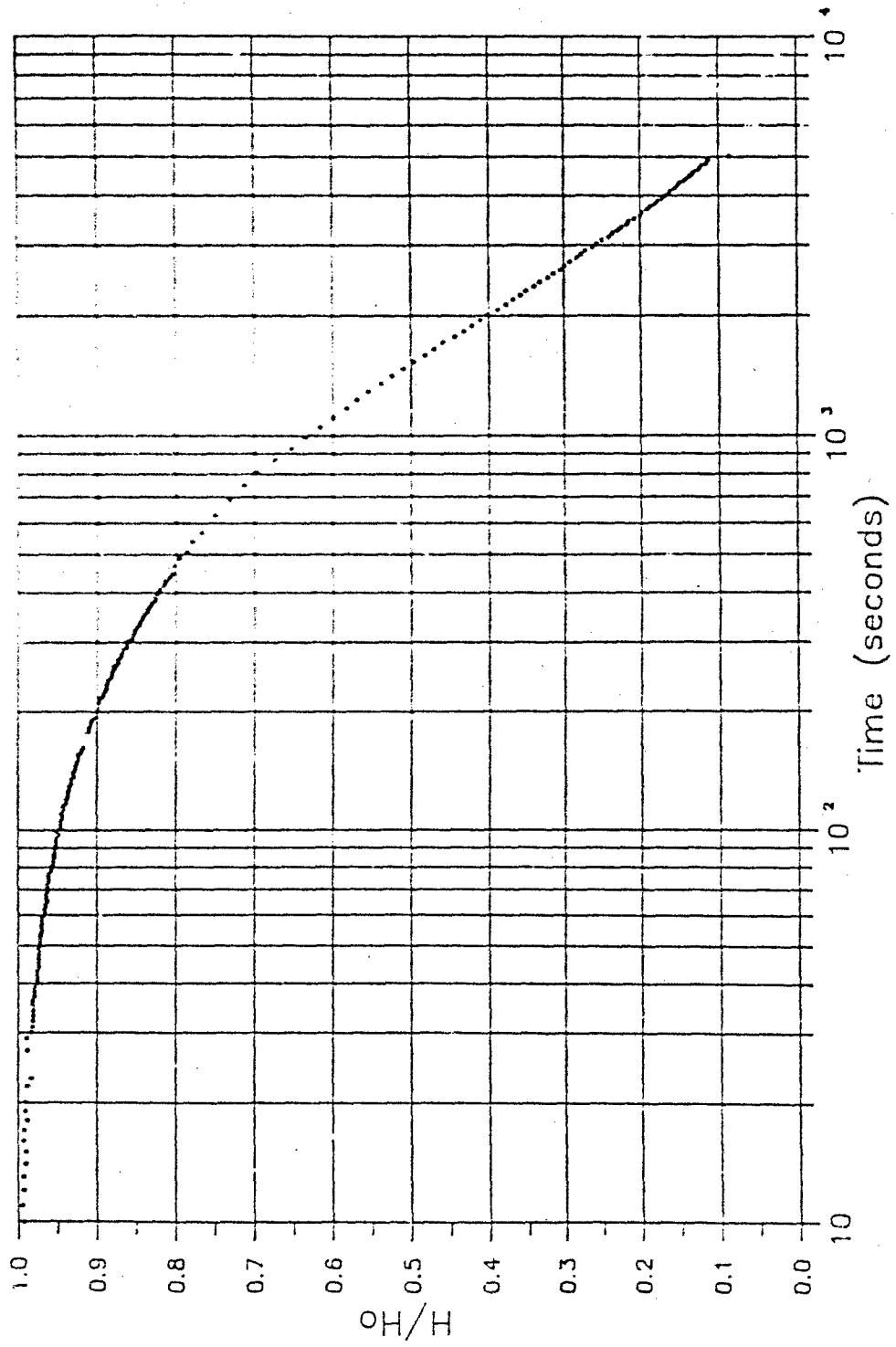


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Slug Out



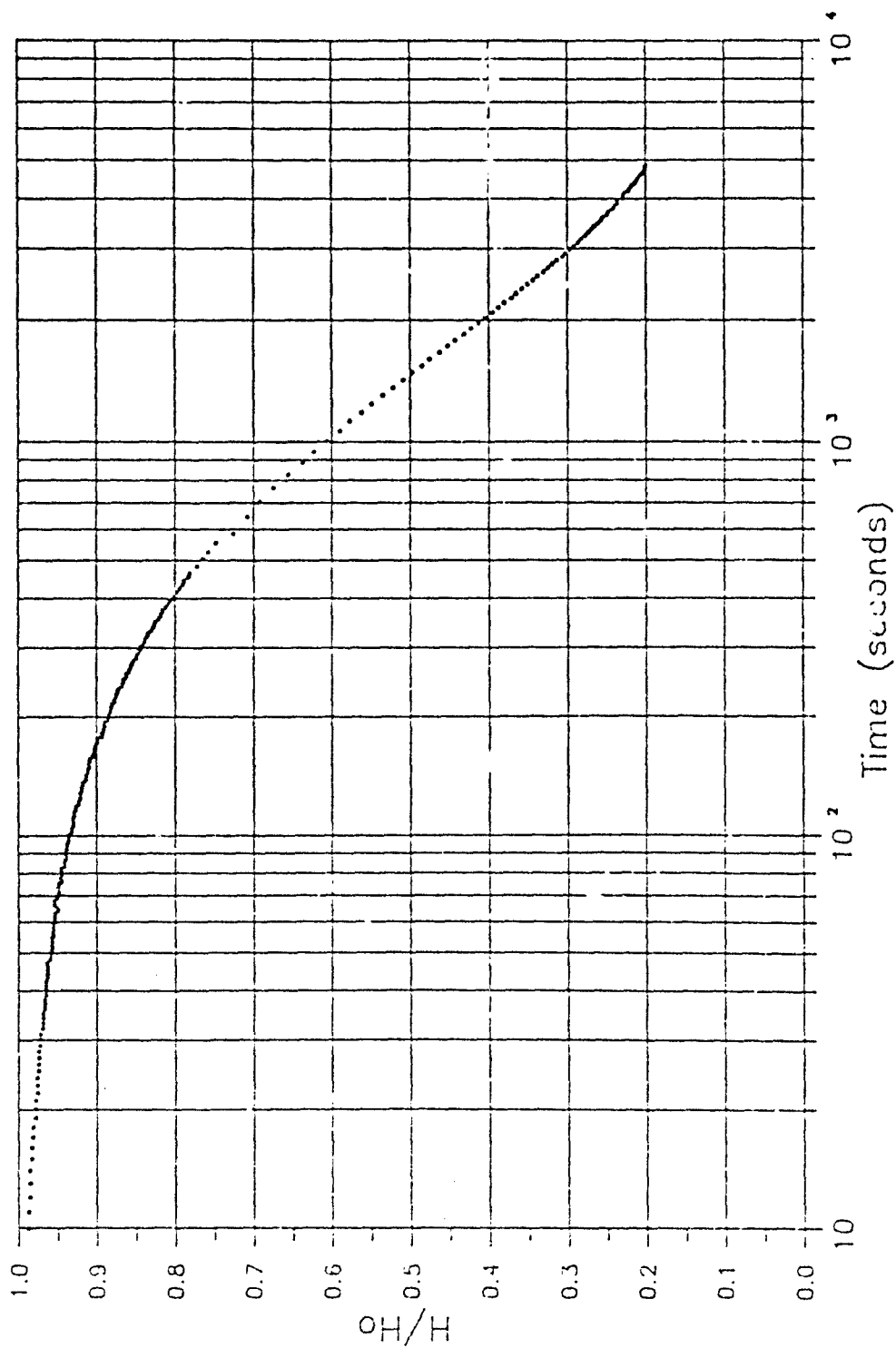
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Slug In

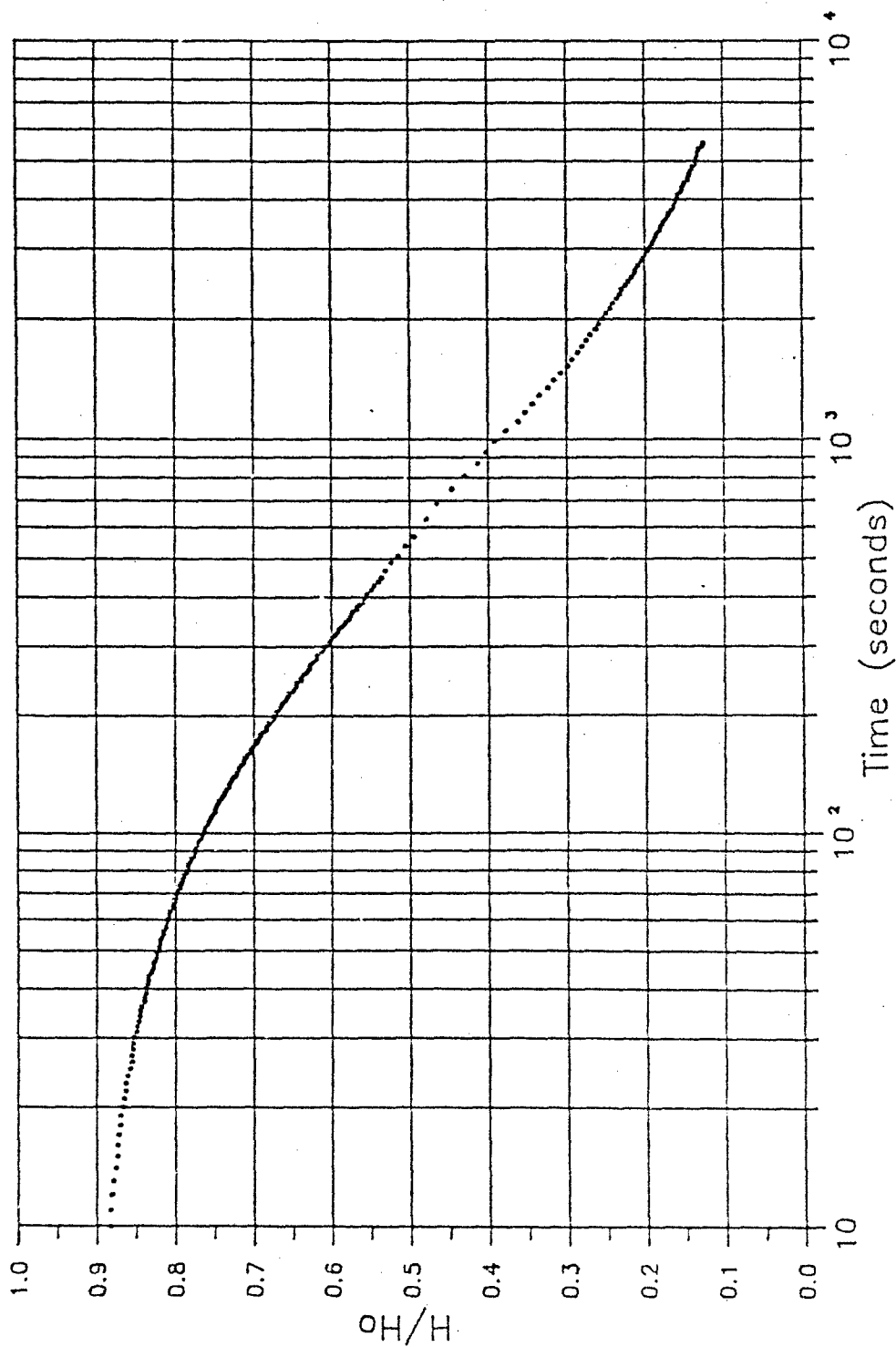


SLUG TEST: WELL #37387 (E-39)

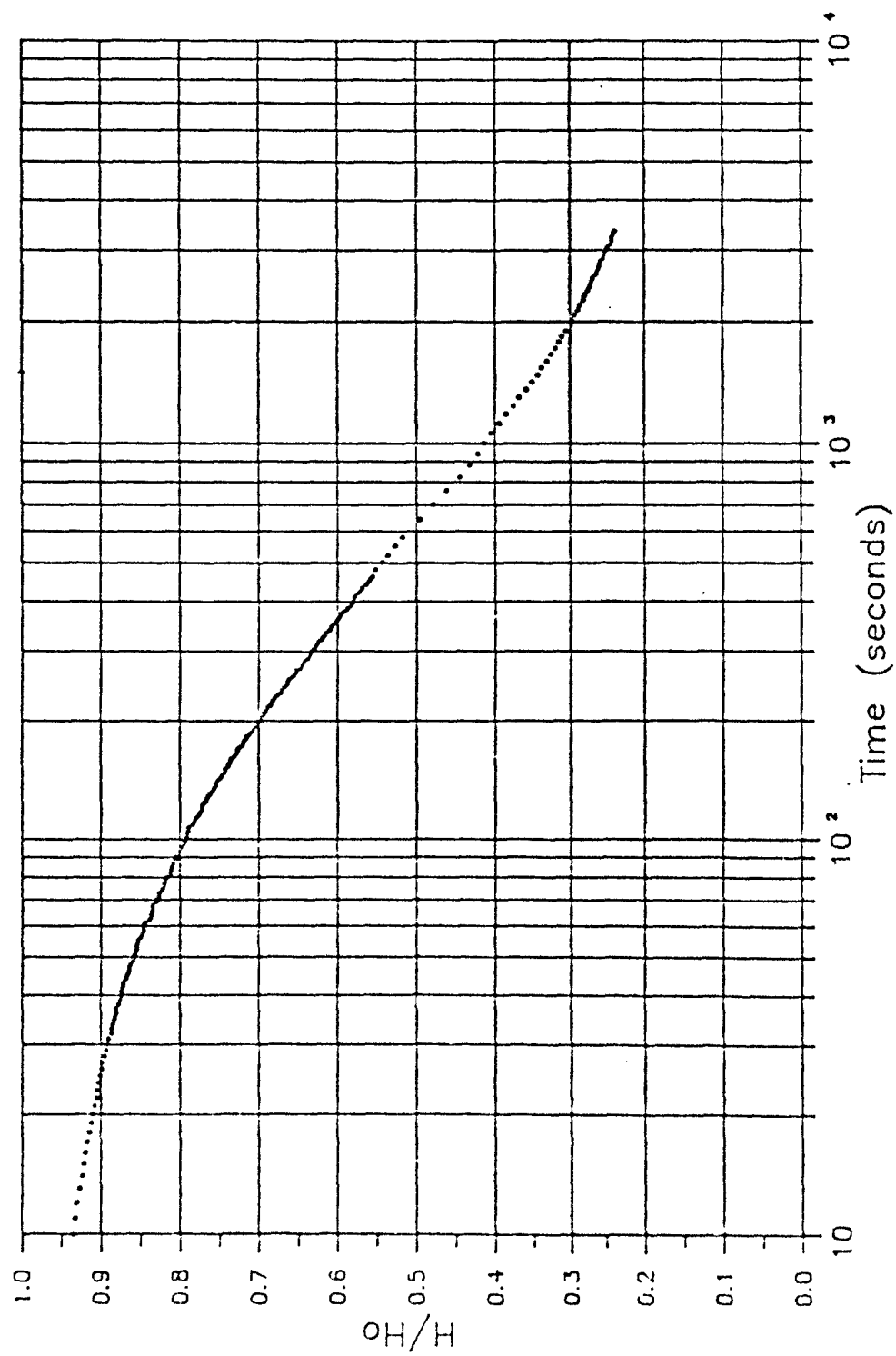
Slug Out



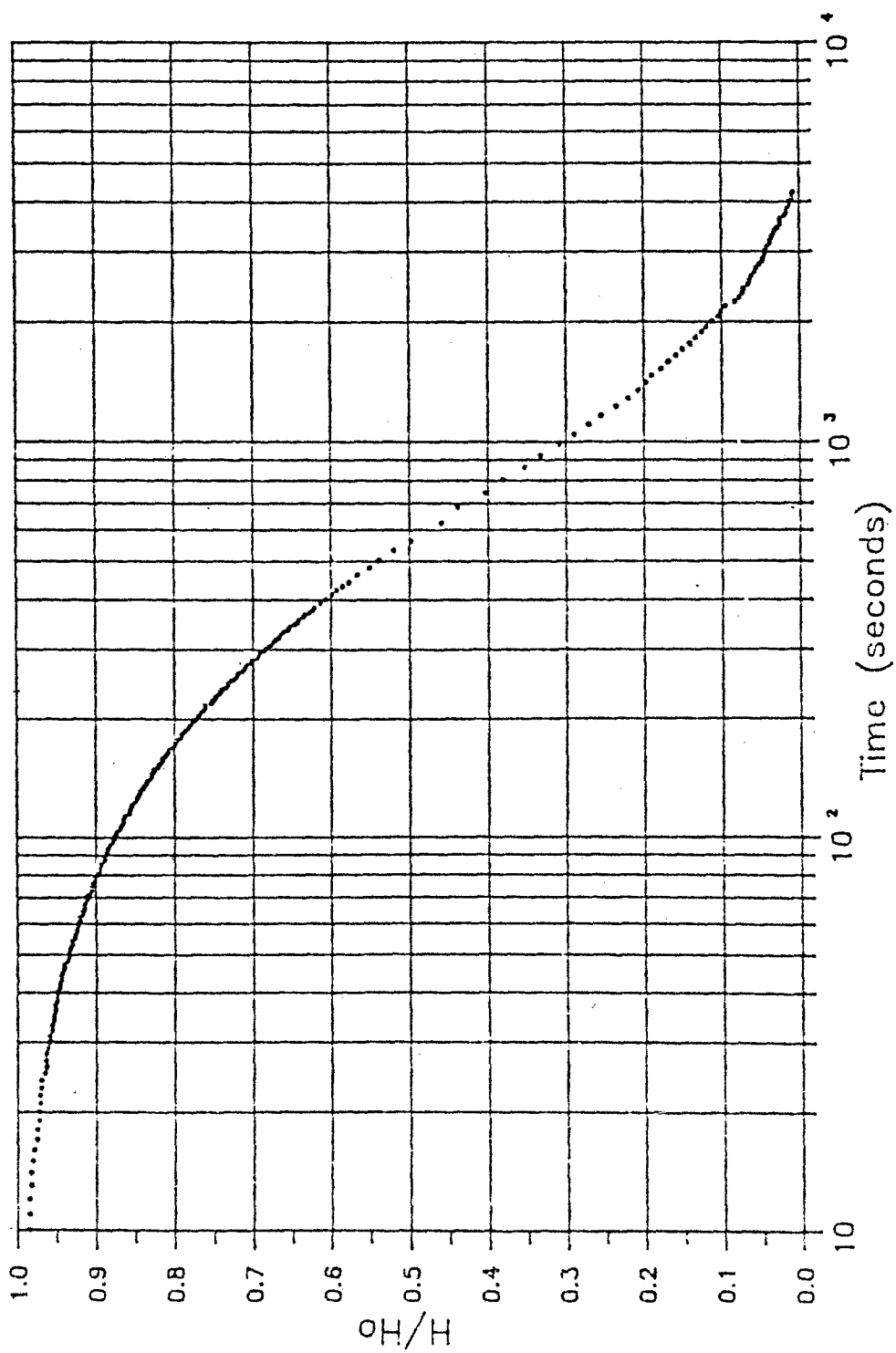
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Slug In



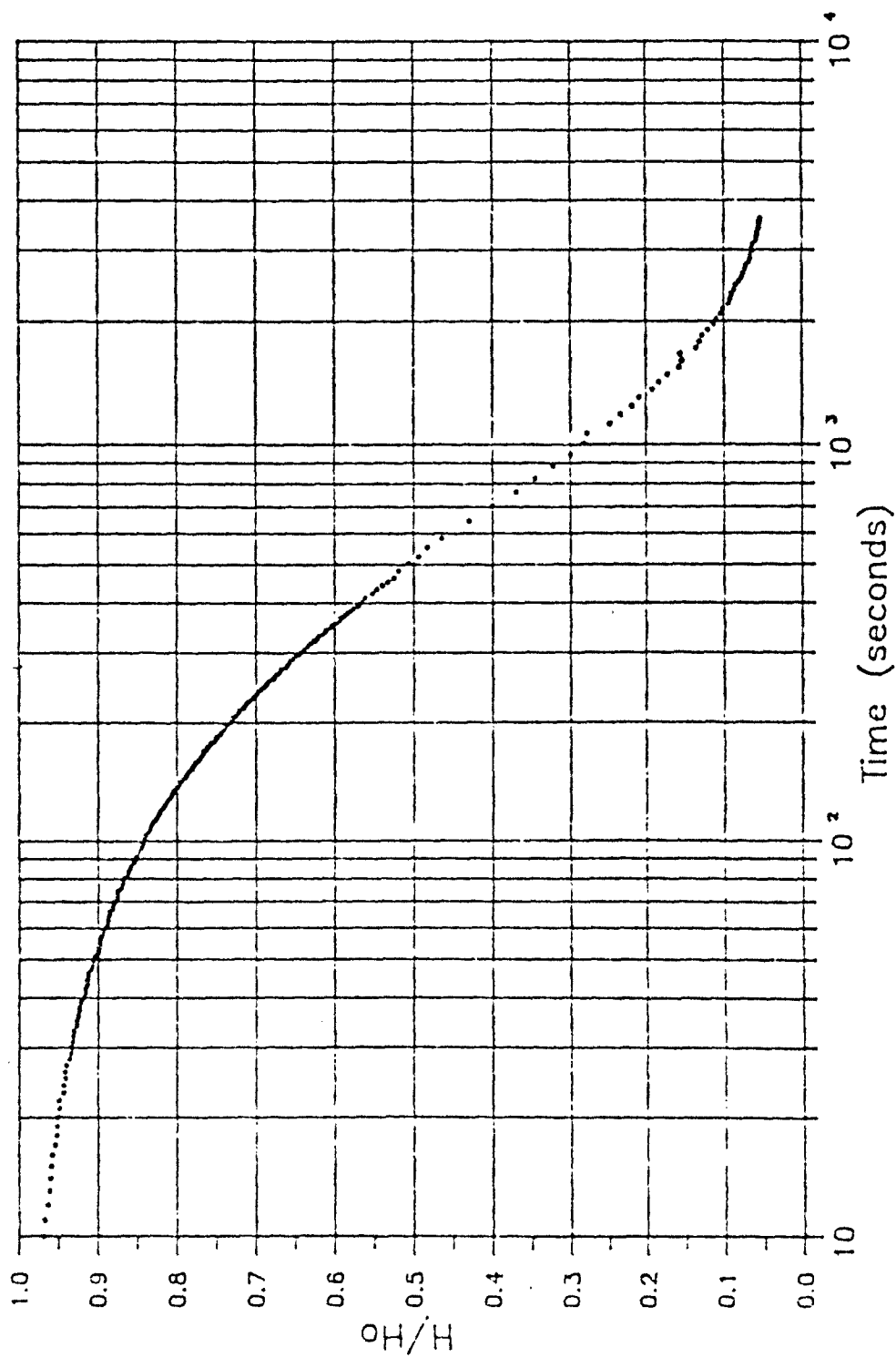
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Slug Out



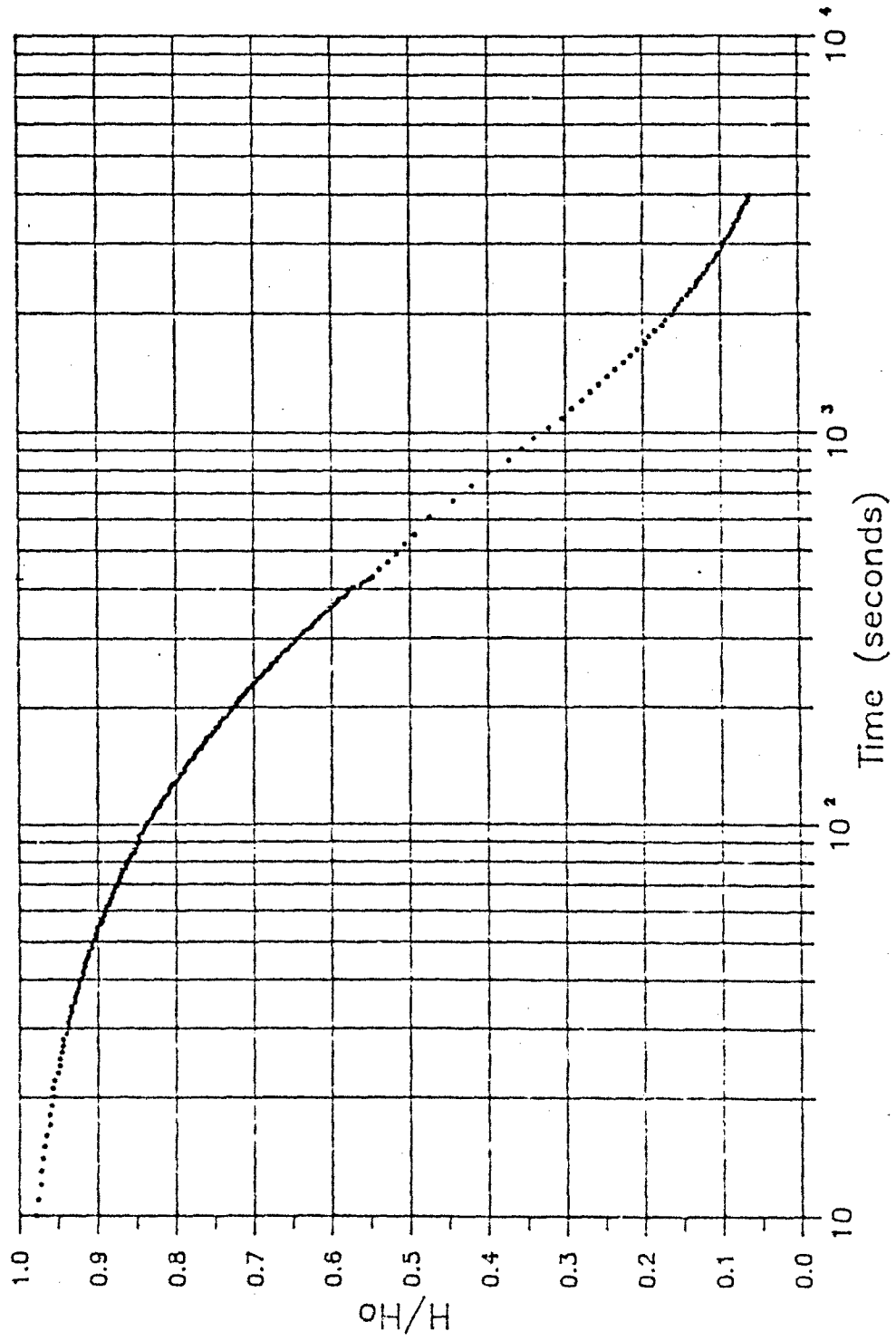
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Slug In



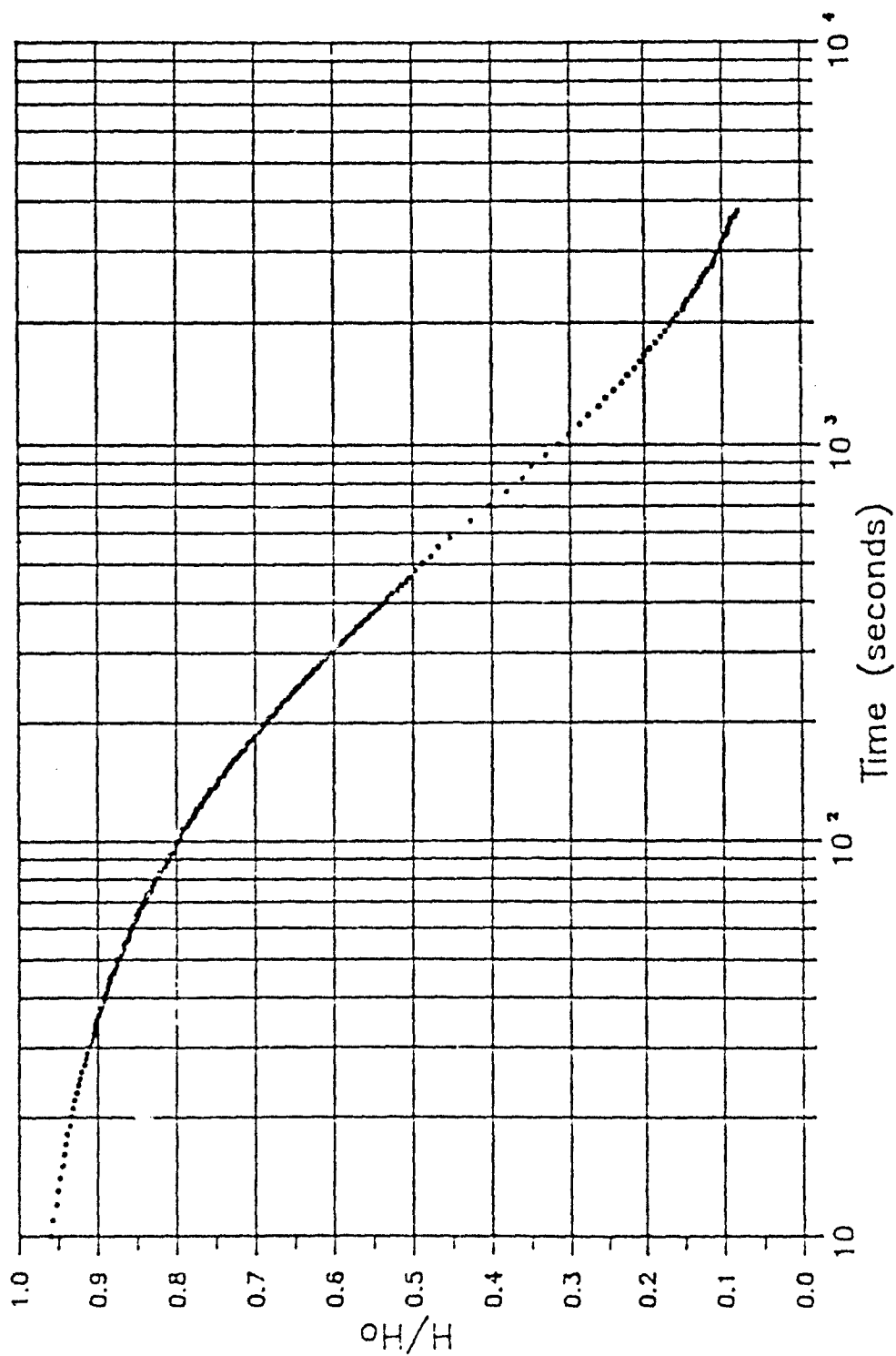
SLUG TEST: WELL #37372 (E-40)
Slug Out



SLUG TEST: WELL #37390 (E-63)
Slug In



SLUG TEST: WELL #37390 (E-63)
Slug Out



D.2 WELL 37367 AQUIFER TEST ANALYSES

Harding Lawson Associates

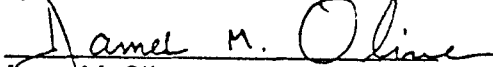
A Report Prepared for


Environmental Science and Engineering, Inc.
7332 S. Alton Way, Suite H
Englewood, Colorado 80112

WELL 37367 AQUIFER TEST
ROCKY MOUNTAIN ARSENAL
ADAMS COUNTY, COLORADO

HLA Job No. 17053,103.10

by


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June 20, 1988

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LIST OF CALCULATION SHEETS

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I. INTRODUCTION

Harding Lawson Associates (HLA) performed a series of aquifer tests for Environmental Science and Engineering, Inc. (ESE) as part of the Rocky Mountain Arsenal Task 39 Offpost RI/FS program. Step-drawdown, constant-rate discharge, and recovery tests were performed in Well 37367 (Boring E-53), located approximately 1 mile north of the Rocky Mountain Arsenal boundary in Adams County, Colorado (Plate 1). The tests were conducted from April 11 to 14, 1988, to estimate aquifer parameters including transmissivity, hydraulic conductivity, and storativity in the offpost operable unit.

II. AQUIFER TEST METHODOLOGY

Prior to the start of the aquifer tests, water levels were monitored in Well 37367 for 42.5 hours to measure any periodic or unusual water level fluctuations. Any water level trends should be identified before aquifer testing to avoid introducing error into aquifer parameter calculation by including water-level responses not attributable to pumping during the aquifer test.

The Well 37367 step-drawdown test was performed for a total of 4.2 hours on April 12, 1988. Water level changes were measured in Well 37367 using an In Situ SE1000B Hermit datalogger and pressure transducer.

The constant-rate discharge test in Well 37367 was performed April 13 through 14, 1988. Water-level changes were monitored in Wells 37367, 37400, and 37401 (Plate 1) with pressure transducers and the data stored on In Situ SE1000B Hermit dataloggers while Well 37367 was pumped for 24.0 hours. Water-level recovery was measured for 4.0 hours in all wells after the pump was shut off.

Discharge water from both the step-drawdown and constant-rate tests was pumped into three 20,000 gallon storage tankers. Disposal of this water was handled by ESE.

Well 37367 was selected as the pumping well by ESE because it is considered representative of the aquifer materials observed in the Northern Contaminant Pathway in the Offpost Operable Unit. Wells 37400 and 37401 were installed by ESE to be used as observation wells for the aquifer test. Well 37400 is 39.36 feet north of Well 37367, and Well 37401 is 81.33 feet north of Well 37367. Geologic boring logs for Wells 37367, 37400 and 37401 are in Appendix A. The geologic logs show the aquifer zone to be comprised primarily of silty and clayey fine- to coarse-grained sand, with some sandy silt.

Discharge Rate and Measurement

A totalizing Rockwell International flowmeter was to have been used to monitor flow during the aquifer tests. However, on-site calibration of the flowmeter indicated that it

was inaccurate at the low pumping rates to be used during the aquifer tests. Because no other flowmeters were available for use during the tests, a calibrated 55-gallon drum (5-gallon bucket for low flow rates) was used to measure the pumping flow rate. Flow measurements were made by timing the filling of the calibrated drum (or bucket). Flow was measured at the end of the 100-foot discharge line, located approximately 13 feet above ground level at the top of the storage tank.

During the step-drawdown test, the discharge rate of the pump in Well 37367 was increased in four increments from an initial rate of 8.1 gallons per minute (gpm) to a final rate of 36.7 gpm. Discharge rate measurements taken during each step are given in Table 1.

During the constant-rate discharge test, the discharge rate of the submersible pump in Well 37367 was held reasonably constant at an average rate of 32.3 gpm. The pumping rate varied less than 3 percent from the average throughout the test. Flow measurements were taken frequently throughout the test to verify the constancy of the discharge rate. Table 2 presents the discharge rate data for the constant-rate discharge test.

III. AQUIFER TEST RESULTS

Based upon the geologic boring log of Boring E53A (Well 37367) and water-level data, the aquifer zone tested was interpreted to be an unconfined aquifer, and appropriate analysis methods were chosen. The hydraulic properties of the aquifer were evaluated from the constant-rate and recovery test data using type curve and straight-line graphical methods (Theis, 1935; Jacob, 1950; and Prickett, 1965). Graphs of drawdown versus log time, log drawdown versus log time, and residual drawdown versus log dimensionless time were constructed for each well monitored (Plates 4 through 11). On all graphs, drawdown was corrected to account for changes in saturated thickness (Jacob, 1950). The graphs are used for solving equations which express the relationship between the hydraulic properties of an aquifer and hydraulic response of an aquifer to pumping.

Aquifer parameters calculated (Calculation Sheets 1 through 8) using water-level response data from the constant-rate discharge test are presented on Table 3. The arithmetic mean of values calculated from different analytical methods for each observation well describes the average value of transmissivity and hydraulic conductivity. Where transmissivity and hydraulic conductivity were determined at more than one observation well, the geometric mean of these values describes the average value of the parameter for the aquifer test. The arithmetic mean of all methods for all observation wells describes the average value of storativity. These methods were used to calculate mean values because transmissivity has been shown to be log normally distributed in space, and storativity to be normally distributed in space (Freeze, 1975).

A. Step-Drawdown Test

The step-drawdown test was performed in Well 37367 on April 12, 1988. A plot of water-level drawdown versus time for Well 37367 is shown on Plate 3. Drawdown data collected during the step-drawdown test are tabulated in Table 4. Flow rate measurements for each step are summarized in Table 1. The drawdown versus time plot shows a short

transitional period between changing discharge rates. Fluctuations observed in the drawdown data during later steps were caused by unstable flow rates due to a generator malfunction.

The main purpose of the step-drawdown test was to determine an optimal flow rate for the constant-rate discharge test. The optimal flow rate for the test is one that can be sustained for at least 24 hours without dewatering the well. From the step-drawdown test data, it was estimated that a flow rate of 30-35 gpm would be appropriate for the constant-rate discharge test. Under ideal circumstances, data from a step-drawdown test can be used to calculate well efficiency. However, this well parameter could not be estimated because of fluctuations in drawdown caused by the generator malfunction.

B. Constant-Rate Discharge Test

Prior to the aquifer testing, water levels were monitored in Well 37367 to assess the potential for outside influences on water levels. The results of this monitoring are shown on Plate 2. During the 42.5-hour period in which Well 37367 was monitored, water levels decreased approximately 0.2 feet. The decrease was fairly constant throughout the period, indicating that the source of the decrease was not a diurnal fluctuation. The fluctuations may possibly be attributed to seasonal variations or an unidentified pumping well.

The constant-rate discharge test was performed in Well 37367 on April 13-14, 1988. Table 3 summarizes the aquifer test results. Drawdown and recovery data collected during the constant-rate discharge test are tabulated on Tables 5 through 10. Calculations made in estimating the aquifer parameters shown in Table 3 are presented on Sheets 1-8. Graphs of the data are shown on Plates 4 through 11. Drawdown values have been corrected to account for decreasing saturated thicknesses.

Calculated transmissivity values ranged from 4,000 ft^2/day to 8,800 ft^2/day , with a geometric mean of 6,600 ft^2/day . These values are typical for the well-graded sand and gravels comprising the aquifer zone. A value of 360 ft/day was estimated for hydraulic conductivity, using the screened intervals of the observation wells as the aquifer thickness.

Three segments are observed in the drawdown data from the observation wells, representing different aquifer response conditions. For the first segment, a value of 1.9×10^{-3} was estimated for aquifer storativity. This value is lower than the typical value range expected for an unconfined alluvial aquifer and is indicative of the early-time or artesian response of the aquifer (Neuman, 1972). The second segment of the drawdown curve is nearly flat and indicates delayed ground-water yield following dewatering of saturated material. During this time, vertical recharge to the saturated zone by delayed yield partially compensates for drawdown from pumping. An accurate estimate of transmissivity and storativity cannot be made during this period. The late-time (third segment) response is representative of the unconfined response of the aquifer and is controlled by the specific yield of materials at the water table. Delayed yield effects were observed in the 24-hour constant-rate discharge test, and the late-time or unconfined response was not fully developed before the test was terminated. To fully develop the late-time curve, the test would have had to run for several days; it is doubtful that the additional data so gained would have added significantly to the refinement of aquifer parameter estimates. Therefore, the storativity value of 1.9×10^{-3} representative of the early-time artesian is the only such value which is estimated from the aquifer test, and is not representative of the late-time specific yield of the aquifer.

Table 1
Step-Drawdown Test Discharge Rate Measurements

Step 0

Time	Flow Rate (gpm)
9:11	Start of Test
9:18	7.4
9:20	8.5
9:30	8.7
10:00	5.5
10:05	5.5
10:10	8.6
10:13	8.5

Time-weighted average flow rate 8.1 gpm
Length of step: 66 min

Step 1

Time	Flow Rate (gpm)
10:17	Start of Test
10:18	18.7
10:19	14.3
10:20	13.6
10:21	13.0
10:22	14.3
10:33	15.0
10:39	13.6
10:45	15.0
10:55	15.0
11:15	14.3

Time-weighted average flow rate 14.9 gpm
Length of step: 62 min

Step 2

Time	Flow Rate (gpm)
11:21	Start of Test
11:21	25.0
11:22	25.6
11:23	26.7
11:24	28.1
11:25	30.0
11:26	30.0
11:27	28.6
11:28	28.6
11:29	28.6
11:50	28.6
12:22	28.6

Time-weighted average flow rate 28.5 gpm
Length of step: 62 min

Step 3

Time	Flow Rate (gpm)
12:24	Start of Test
12:25	42.8
12:26	40.0
12:27	39.1
12:28	39.3
12:35	36.0
12:38	36.4
12:41	36.1
13:14	35.8
13:23	35.6

Time-weighted average flow rate 36.7 gpm
Length of step: 60 min

Table 2
Constant-Rate Test Discharge Rate Measurements

Date	Time	Flow Rate (gpm)
4/13/88	15:43	Start of Test
	15:47	32.6
	15:53	32.4
	15:56	32.6
	16:25	32.8
	16:44	32.3
	17:58	32.1
	19:00	31.9
	20:00	32.8
	21:00	32.2
	22:00	32.5
	23:00	32.7
	23:58	33.1
4/14/88	01:04	32.6
	01:59	32.1
	03:00	32.0
	04:04	32.6
	05:02	32.2
	06:04	32.4
	07:05	32.5
	09:02	31.9
	11:05	32.3
	13:05	32.3
	15:30	31.9
Time-weighted average flow rate		32.3 gpm

Table 3. Summary of Well 37367 Aquifer Test

Dates Tested: April 13-14, 1988
 Pumped Well: 37367
 Discharge Rate: 32.3 gpm
 Pumping Duration: 24.0 hours
 Recovery Duration: 4.0 hours

Observation Well	Distance to Pumped Well (ft)	Magnitude Water Level Response (ft)	Method of Analysis	Transmissivity (ft ² /day)	Hydraulic Conductivity (ft/day)	Storativity (dimensionless)
37367	0	12.14	SL RD	4,000 7,600	210 400	- -
37400	39.36	0.58	LL SL RD	7,200 6,000 7,100	380 320 370	1.9 x 10 ⁻³ 2.1 x 10 ⁻³ -
37401	81.33	0.33	LL SL RD	6,300 8,800 7,100	350 490 390	1.9 x 10 ⁻³ 1.7 x 10 ⁻³ -

T geometric = 6,600 ft²/day
 K geometric = 3.60 ft/day
 S arithmetic = 1.9 x 10⁻³ (dimensionless)

LL = Unconfined Aquifer Type Curve Method (Prickett, 1965)
 SL = Modified Non-Equilibrium Method (Jacob, 1950)
 RD = Residual Drawdown Method (Theis, 1935)

Table 4.
 Drawdown Data for Step - Drawdown Test
 Well 37363

Pumping Well: 37367
 Observation Well: 37367
 Step - Drawdown Test
 04/12/88

Step# 0 04/12 09:11

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.01
0.0033	0.07
0.0066	1.12
0.0099	-0.35
0.0133	-0.34
0.0166	0.13
0.0200	0.18
0.0233	0.15
0.0266	0.12
0.0300	0.11
0.0333	0.12
0.0500	0.11
0.0666	0.11
0.0833	0.10
0.1000	0.13
0.1166	0.12
0.1333	0.11
0.1500	0.11
0.1666	0.11
0.1833	0.12
0.2000	0.12
0.2166	0.12
0.2333	0.13
0.2500	0.30
0.2666	0.48
0.2833	0.60
0.3000	0.89
0.3166	1.12
0.3333	1.37
0.4167	1.86
0.5000	1.12
0.5833	0.99
0.6667	0.97
0.7500	0.95
0.8333	0.93
0.9167	0.92
1.0000	0.91
1.0833	0.93
1.1667	0.96
1.2500	0.98
1.3333	1.01
1.4166	1.03
1.5000	1.04
1.5833	1.04
1.6667	1.05

Table 4. (continued)

1.7500	1.05
1.8333	1.04
1.9167	1.06
2.0000	1.06
2.5000	1.07
3.0000	1.08
3.5000	1.06
4.0000	1.08
4.5000	1.09
5.0000	1.08
5.5000	1.06
6.0000	1.07
6.5000	1.09
7.0000	1.18
7.5000	1.21
8.0000	1.22
8.5000	1.24
9.0000	1.26
9.5000	1.25
10.0000	1.27
12.0000	1.26
14.0000	1.28
16.0000	1.29
18.0000	1.25
20.0000	1.26
22.0000	1.29
24.0000	1.27
26.0000	1.24
28.0000	1.30
30.0000	1.27
32.0000	1.27
34.0000	1.29
36.0000	1.27
38.0000	1.26
40.0000	1.26
42.0000	1.28
44.0000	1.29
46.0000	1.29
48.0000	1.26
50.0000	1.27
52.0000	0.89
54.0000	0.87
56.0000	0.86
58.0000	0.15
60.0000	1.07
62.0000	1.15
64.0000	1.17
66.0000	1.14

Step# 1 04/12 10:17

Elapsed Time (min)	Drawdown Value (ft)
0.0000	1.17

Table 4. (continued)

0.0033	1.53
0.0066	1.34
0.0099	1.21
0.0133	1.47
0.0166	1.35
0.0200	1.27
0.0233	1.32
0.0266	1.35
0.0300	1.36
0.0333	1.39
0.0500	1.49
0.0666	1.56
0.0833	1.60
0.1000	1.62
0.1166	1.66
0.1333	1.68
0.1500	1.70
0.1666	1.72
0.1833	1.72
0.2000	1.75
0.2166	1.76
0.2333	1.77
0.2500	1.78
0.2666	1.81
0.2833	1.82
0.3000	1.85
0.3166	1.83
0.3333	1.86
0.4167	1.96
0.5000	2.06
0.5833	2.11
0.6667	2.15
0.7500	2.18
0.8333	2.21
0.9167	2.25
1.0000	2.23
1.0833	2.15
1.1667	2.17
1.2500	2.14
1.3333	2.16
1.4166	2.14
1.5000	2.15
1.5833	2.15
1.6667	2.15
1.7500	2.15
1.8333	2.14
1.9167	2.14
2.0000	2.15
2.5000	2.15
3.0000	2.15
3.5000	2.17
4.0000	2.19
4.5000	2.18
5.0000	2.23
5.5000	2.22
6.0000	2.20

Table 4. (continued)

6.5000	2.21
7.0000	2.22
7.5000	2.22
8.0000	2.23
8.5000	2.24
9.0000	2.26
9.5000	2.26
10.0000	2.22
12.0000	2.23
14.0000	2.25
16.0000	2.25
18.0000	2.22
20.0000	2.23
22.0000	2.26
24.0000	2.22
26.0000	2.29
28.0000	2.27
30.0000	2.29
32.0000	2.29
34.0000	2.29
36.0000	2.29
38.0000	2.30
40.0000	2.31
42.0000	2.29
44.0000	2.31
46.0000	2.31
48.0000	2.31
50.0000	2.31
52.0000	2.30
54.0000	2.33
56.0000	2.31
58.0000	2.32
60.0000	2.31
62.0000	2.31

Step# 2 04/12 11:20

Elapsed Time (min)	Drawdown Value (ft)
0.0000	2.32
0.0033	2.33
0.0066	2.46
0.0099	2.82
0.0133	2.53
0.0166	2.53
0.0200	2.65
0.0233	2.56
0.0266	2.67
0.0300	2.62
0.0333	2.72
0.0500	2.96
0.0666	3.13
0.0833	3.30
0.1000	3.47

Table 4. (continued)

0.1166	3.58
0.1333	3.66
0.1500	3.76
0.1666	3.85
0.1833	3.89
0.2000	3.98
0.2166	3.95
0.2333	4.05
0.2500	4.05
0.2666	4.15
0.2833	4.14
0.3000	4.18
0.3166	4.23
0.3333	4.27
0.4167	4.43
0.5000	4.56
0.5833	4.61
0.6667	4.71
0.7500	4.77
0.8333	4.83
0.9167	4.88
1.0000	4.95
1.0833	5.00
1.1667	5.02
1.2500	5.07
1.3333	5.07
1.4166	5.25
1.5000	5.23
1.5833	5.32
1.6667	5.38
1.7500	5.39
1.8333	5.43
1.9167	5.51
2.0000	5.48
2.5000	5.55
3.0000	6.14
3.5000	6.40
4.0000	6.45
4.5000	6.56
5.0000	6.53
5.5000	6.41
6.0000	6.34
6.5000	6.35
7.0000	6.36
7.5000	6.42
8.0000	6.44
8.5000	6.45
9.0000	6.46
9.5000	6.49
10.0000	6.48
12.0000	6.51
14.0000	6.58
16.0000	6.60
18.0000	6.62
20.0000	6.60
22.0000	6.62

Table 4. (continued)

24.0000	6.64
26.0000	6.04
28.0000	6.73
30.0000	6.74
32.0000	6.73
34.0000	6.77
36.0000	6.79
38.0000	6.75
40.0000	6.79
42.0000	6.77
44.0000	6.77
46.0000	6.82
48.0000	6.80
50.0000	6.83
52.0000	6.81
54.0000	6.84
56.0000	6.91
58.0000	6.86
60.0000	6.87
62.0000	6.85

Step# 3 04/12 12:24

Elapsed Time (min)	Drawdown Value (ft)
0.0000	6.80
0.0033	6.88
0.0066	6.88
0.0099	6.91
0.0133	6.89
0.0166	6.90
0.0200	6.98
0.0233	7.12
0.0266	7.04
0.0300	4.07
0.0333	7.14
0.0500	7.49
0.0666	7.78
0.0833	8.07
0.1000	8.38
0.1166	8.62
0.1333	8.91
0.1500	9.09
0.1666	9.29
0.1833	9.42
0.2000	9.58
0.2166	9.78
0.2333	9.88
0.2500	9.98
0.2666	10.11
0.2833	10.19
0.3000	10.22
0.3166	10.30
0.3333	10.34

Table 4. (continued)

0.4167	10.63
0.5000	10.83
0.5833	10.94
0.6667	11.18
0.7500	11.44
0.8333	11.59
0.9167	11.75
1.0000	11.48
1.0833	11.18
1.1667	10.96
1.2500	10.87
1.3333	10.82
1.4166	10.78
1.5000	10.75
1.5833	10.80
1.6667	10.77
1.7500	10.71
1.8333	10.75
1.9167	10.76
2.0000	10.73
2.5000	10.85
3.0000	10.89
3.5000	10.33
4.0000	10.39
4.5000	10.37
5.0000	10.15
5.5000	10.36
6.0000	10.58
6.5000	10.63
7.0000	10.65
7.5000	10.64
8.0000	10.85
8.5000	10.76
9.0000	10.84
9.5000	10.81
10.0000	11.03
12.0000	10.96
14.0000	11.20
16.0000	10.81
18.0000	11.34
20.0000	11.42
22.0000	11.53
24.0000	11.52
26.0000	11.56
28.0000	11.55
30.0000	11.68
32.0000	11.66
34.0000	11.67
36.0000	11.72
38.0000	11.76
40.0000	11.78
42.0000	11.77
44.0000	11.81
46.0000	11.84
48.0000	11.40
50.0000	11.86

Table 4. (continued)

52.0000	11.69
54.0000	11.87
56.0000	11.46
58.0000	11.97
60.0000	11.94

Table 5.
Drawdown Data for Constant-Rate Test
Well 37367

Pumping Well: 37367
Observation Well: 37367
Constant - Rate Discharge Test
04/13/88 15:43

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.01
0.0033	0.01
0.0066	1.49
0.0099	1.59
0.0133	0.55
0.0166	0.00
0.0200	0.64
0.0233	0.96
0.0266	0.96
0.0300	1.04
0.0333	1.16
0.0500	1.79
0.0666	2.28
0.0833	2.71
0.1000	3.12
0.1166	3.47
0.1333	3.85
0.1500	4.21
0.1666	4.44
0.1833	4.66
0.2000	4.88
0.2166	5.09
0.2333	5.30
0.2500	5.44
0.2666	5.57
0.2833	5.69
0.3000	5.85
0.3166	6.01
0.3333	6.14
0.4167	6.71
0.5000	7.12
0.5833	7.47
0.6667	7.70
0.7500	7.97
0.8333	8.16
0.9167	8.23
1.0000	8.38
1.0833	8.51
1.1667	8.60
1.2500	8.76
1.3333	8.91
1.4166	9.00
1.5000	9.11
1.5833	9.25
1.6667	9.35
1.7500	9.44
1.8333	9.50

Table 5. (continued)

1.9167	9.59
2.0000	9.65
2.5000	9.92
3.0000	10.07
3.5000	10.10
4.0000	10.17
4.5000	10.19
5.0000	10.22
5.5000	10.22
6.0000	10.25
6.5000	10.32
7.0000	10.32
7.5000	10.27
8.0000	10.35
8.5000	10.38
9.0000	10.41
9.5000	10.40
10.0000	10.43
12.0000	10.47
14.0000	10.54
16.0000	10.53
18.0000	10.54
20.0000	10.60
22.0000	10.71
24.0000	10.74
26.0000	10.77
28.0000	10.78
30.0000	10.83
32.0000	10.79
34.0000	10.90
36.0000	10.88
38.0000	10.93
40.0000	10.92
42.0000	10.96
44.0000	10.94
46.0000	10.98
48.0000	11.02
50.0000	10.97
52.0000	11.04
54.0000	11.07
56.0000	11.05
58.0000	11.12
60.0000	11.10
62.0000	11.11
64.0000	11.18
66.0000	11.10
68.0000	11.11
70.0000	11.11
72.0000	11.15
74.0000	11.13
76.0000	11.18
78.0000	11.04
80.0000	11.02
82.0000	11.02
84.0000	11.00
86.0000	11.07

Table 5. (continued)

88.0000	11.06
90.0000	11.08
92.0000	11.06
94.0000	11.08
96.0000	11.07
98.0000	11.13
100.0000	11.11
110.0000	11.14
120.0000	11.18
130.0000	11.19
140.0000	11.25
150.0000	11.31
160.0000	11.33
170.0000	11.32
180.0000	11.41
190.0000	11.42
200.0000	11.39
210.0000	11.44
220.0000	11.47
230.0000	11.49
240.0000	11.50
250.0000	11.49
260.0000	11.50
270.0000	11.51
280.0000	11.52
290.0000	11.53
300.0000	11.54
310.0000	11.56
320.0000	11.60
330.0000	11.60
340.0000	11.58
350.0000	11.60
360.0000	11.58
370.0000	11.60
380.0000	11.67
390.0000	11.64
400.0000	11.68
410.0000	11.71
420.0000	11.70
430.0000	11.70
440.0000	11.70
450.0000	11.69
460.0000	11.72
470.0000	11.77
480.0000	11.80
490.0000	11.81
500.0000	11.74
510.0000	11.80
520.0000	11.78
530.0000	11.82
540.0000	11.83
550.0000	11.83
560.0000	11.83
570.0000	11.81
580.0000	11.78
590.0000	11.90

Table 5. (continued)

600.0000	11.89
610.0000	11.88
620.0000	11.86
630.0000	11.87
640.0000	11.87
650.0000	11.88
660.0000	11.89
670.0000	11.91
680.0000	11.88
690.0000	11.87
700.0000	11.88
710.0000	11.94
720.0000	11.93
730.0000	11.91
740.0000	11.90
750.0000	11.85
760.0000	11.92
770.0000	11.95
780.0000	11.91
790.0000	11.97
800.0000	11.91
810.0000	11.94
820.0000	11.99
830.0000	11.94
840.0000	12.02
850.0000	12.00
860.0000	11.97
870.0000	11.92
880.0000	11.95
890.0000	11.96
900.0000	11.97
910.0000	11.99
920.0000	12.05
930.0000	12.05
940.0000	12.05
950.0000	12.00
960.0000	12.05
970.0000	12.07
980.0000	12.07
990.0000	12.14
1000.0000	12.12
1030.0000	12.13
1060.0000	12.06
1090.0000	12.01
1120.0000	12.04
1150.0000	12.05
1180.0000	12.11
1210.0000	12.05
1240.0000	12.14
1270.0000	12.04
1300.0000	12.07
1330.0000	12.08
1360.0000	12.12
1390.0000	12.06
1420.0000	12.08

Table 6.
Drawdown Data for Constant-Rate Test
Well 37400

Pumping Well: 37367
Observation Well: 37400
Constant Rate Discharge Test
04/13/88 15:43

Elapsed Time (min)	Value (ft)
0.0000	0.02
0.0033	0.02
0.0066	0.02
0.0099	0.02
0.0133	0.03
0.0166	0.03
0.0200	0.02
0.0233	0.02
0.0266	0.02
0.0300	0.03
0.0333	0.03
0.0500	0.03
0.0666	0.03
0.0833	0.03
0.1000	0.03
0.1166	0.03
0.1333	0.04
0.1500	0.04
0.1666	0.05
0.1833	0.05
0.2000	0.05
0.2166	0.05
0.2333	0.05
0.2500	0.06
0.2666	0.06
0.2833	0.06
0.3000	0.06
0.3166	0.06
0.3333	0.06
0.4167	0.08
0.5000	0.09
0.5833	0.10
0.6667	0.11
0.7500	0.11
0.8333	0.11
0.9167	0.12
1.0000	0.12
1.0833	0.13
1.1667	0.13
1.2500	0.13
1.3333	0.13
1.4166	0.14
1.5000	0.15
1.5833	0.15
1.6667	0.15
1.7500	0.15
1.8333	0.16
1.9167	0.16

Table 6. (continued)

2.0000	0.16
2.5000	0.18
3.0000	0.19
3.5000	0.20
4.0000	0.21
4.5000	0.22
5.0000	0.22
5.5000	0.23
6.0000	0.24
6.5000	0.25
7.0000	0.25
7.5000	0.25
8.0000	0.26
8.5000	0.26
9.0000	0.26
9.5000	0.27
10.0000	0.27
12.0000	0.29
14.0000	0.30
16.0000	0.31
18.0000	0.33
20.0000	0.33
22.0000	0.34
24.0000	0.35
26.0000	0.36
28.0000	0.37
30.0000	0.38
32.0000	0.39
34.0000	0.39
36.0000	0.40
38.0000	0.40
40.0000	0.41
42.0000	0.42
44.0000	0.43
46.0000	0.42
48.0000	0.43
50.0000	0.43
52.0000	0.44
54.0000	0.44
56.0000	0.45
58.0000	0.46
60.0000	0.46
62.0000	0.46
64.0000	0.47
66.0000	0.47
68.0000	0.47
70.0000	0.47
72.0000	0.48
74.0000	0.48
76.0000	0.49
78.0000	0.49
80.0000	0.49
82.0000	0.49
84.0000	0.50
86.0000	0.50
88.0000	0.51

Table 6. (continued)

90.0000	0.51
92.0000	0.51
94.0000	0.51
96.0000	0.51
98.0000	0.52
100.0000	0.52
110.0000	0.53
120.0000	0.54
130.0000	0.54
140.0000	0.54
150.0000	0.55
160.0000	0.56
170.0000	0.56
180.0000	0.56
190.0000	0.56
200.0000	0.56
210.0000	0.56
220.0000	0.56
230.0000	0.56
240.0000	0.56
250.0000	0.56
260.0000	0.56
270.0000	0.56
280.0000	0.56
290.0000	0.56
300.0000	0.56
310.0000	0.56
320.0000	0.56
330.0000	0.56
340.0000	0.56
350.0000	0.56
360.0000	0.56
370.0000	0.56
380.0000	0.56
390.0000	0.56
400.0000	0.56
410.0000	0.56
420.0000	0.56
430.0000	0.56
440.0000	0.56
450.0000	0.56
460.0000	0.56
470.0000	0.56
480.0000	0.56
490.0000	0.56
500.0000	0.56
510.0000	0.56
520.0000	0.56
530.0000	0.56
540.0000	0.56
550.0000	0.56
560.0000	0.56
570.0000	0.56
580.0000	0.56
590.0000	0.56
600.0000	0.56

Table 6. (continued)

610.0000	0.56
620.0000	0.56
630.0000	0.56
640.0000	0.56
650.0000	0.56
660.0000	0.56
670.0000	0.56
680.0000	0.56
690.0000	0.56
700.0000	0.56
710.0000	0.56
720.0000	0.56
730.0000	0.56
740.0000	0.56
750.0000	0.56
760.0000	0.56
770.0000	0.56
780.0000	0.56
790.0000	0.56
800.0000	0.56
810.0000	0.57
820.0000	0.56
830.0000	0.57
840.0000	0.57
850.0000	0.57
860.0000	0.57
870.0000	0.57
880.0000	0.57
890.0000	0.57
900.0000	0.57
910.0000	0.57
920.0000	0.57
930.0000	0.57
940.0000	0.57
950.0000	0.57
960.0000	0.58
970.0000	0.58
980.0000	0.58
990.0000	0.58
1000.0000	0.58
1030.0000	0.58
1060.0000	0.58
1090.0000	0.57
1120.0000	0.57
1150.0000	0.57
1180.0000	0.57
1210.0000	0.57
1240.0000	0.56
1270.0000	0.56
1300.0000	0.57
1330.0000	0.56
1360.0000	0.57
1390.0000	0.57
1420.0000	0.57

Table 7.
Drawdown Data for Constant-Rate Test
Well 37401

Pumping Well: 37367
Observation Well: 37401
Constant Rate Discharge Test
04/13/88 15:43

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.00
0.0033	0.00
0.0066	0.00
0.0099	0.00
0.0133	0.00
0.0166	0.01
0.0200	0.01
0.0233	0.01
0.0266	0.01
0.0300	0.01
0.0333	0.01
0.0500	0.01
0.0666	0.01
0.0833	0.01
0.1000	0.01
0.1166	0.01
0.1333	0.00
0.1500	0.01
0.1666	0.01
0.1833	0.01
0.2000	0.01
0.2166	0.01
0.2333	0.01
0.2500	0.01
0.2666	0.01
0.2833	0.01
0.3000	0.01
0.3166	0.01
0.3333	0.01
0.4167	0.01
0.5000	0.02
0.5833	0.02
0.6667	0.02
0.7500	0.02
0.8333	0.02
0.9167	0.03
1.0000	0.03
1.0833	0.03
1.1667	0.04
1.2500	0.04
1.3333	0.04
1.4167	0.04
1.5000	0.04
1.5833	0.05
1.6667	0.05
1.7500	0.05
1.8333	0.05

Table 7. (continued)

1.9167	0.05
2.0000	0.06
2.5000	0.07
3.0000	0.07
3.5000	0.08
4.0000	0.09
4.5000	0.09
5.0000	0.10
5.5000	0.10
6.0000	0.11
6.5000	0.12
7.0000	0.12
7.5000	0.13
8.0000	0.13
8.5000	0.13
9.0000	0.14
9.5000	0.14
10.0000	0.15
12.0000	0.16
14.0000	0.17
16.0000	0.18
18.0000	0.18
20.0000	0.18
22.0000	0.19
24.0000	0.21
26.0000	0.19
28.0000	0.20
30.0000	0.21
32.0000	0.21
34.0000	0.21
36.0000	0.22
38.0000	0.22
40.0000	0.23
42.0000	0.24
44.0000	0.24
46.0000	0.24
48.0000	0.24
50.0000	0.23
52.0000	0.24
54.0000	0.23
56.0000	0.24
58.0000	0.24
60.0000	0.24
62.0000	0.25
64.0000	0.25
66.0000	0.24
68.0000	0.24
70.0000	0.24
72.0000	0.25
74.0000	0.26
76.0000	0.25
78.0000	0.25
80.0000	0.25
82.0000	0.25
84.0000	0.25
86.0000	0.26

Table 7. (continued)

88.0000	0.26
90.0000	0.26
92.0000	0.26
94.0000	0.26
96.0000	0.26
98.0000	0.27
100.0000	0.27
110.0000	0.26
120.0000	0.26
130.0000	0.27
140.0000	0.28
150.0000	0.27
160.0000	0.27
170.0000	0.27
180.0000	0.27
190.0000	0.27
200.0000	0.26
210.0000	0.26
220.0000	0.26
230.0000	0.26
240.0000	0.26
250.0000	0.26
260.0000	0.26
270.0000	0.27
280.0000	0.26
290.0000	0.26
300.0000	0.26
310.0000	0.26
320.0000	0.27
330.0000	0.26
340.0000	0.26
350.0000	0.26
360.0000	0.26
370.0000	0.26
380.0000	0.27
390.0000	0.27
400.0000	0.26
410.0000	0.26
420.0000	0.26
430.0000	0.26
440.0000	0.27
450.0000	0.27
460.0000	0.26
470.0000	0.26
480.0000	0.26
490.0000	0.26
500.0000	0.27
510.0000	0.27
520.0000	0.27
530.0000	0.26
540.0000	0.27
550.0000	0.26
560.0000	0.27
570.0000	0.27
580.0000	0.27
590.0000	0.27

Table 7. (continued)

600.0000	0.27
610.0000	0.27
620.0000	0.28
630.0000	0.28
640.0000	0.27
650.0000	0.27
660.0000	0.27
670.0000	0.27
680.0000	0.28
690.0000	0.28
700.0000	0.28
710.0000	0.28
720.0000	0.27
730.0000	0.27
740.0000	0.28
750.0000	0.28
760.0000	0.28
770.0000	0.27
780.0000	0.27
790.0000	0.28
800.0000	0.29
810.0000	0.29
820.0000	0.28
830.0000	0.28
840.0000	0.29
850.0000	0.28
860.0000	0.29
870.0000	0.29
880.0000	0.29
890.0000	0.29
900.0000	0.28
910.0000	0.29
920.0000	0.30
930.0000	0.30
940.0000	0.30
950.0000	0.30
960.0000	0.30
970.0000	0.29
980.0000	0.30
990.0000	0.30
1000.0000	0.30
1030.0000	0.29
1060.0000	0.31
1090.0000	0.30
1120.0000	0.30
1150.0000	0.29
1180.0000	0.32
1210.0000	0.31
1240.0000	0.29
1270.0000	0.31
1300.0000	0.33
1330.0000	0.30
1360.0000	0.31
1390.0000	0.33
1420.0000	0.32

Table 8.

Residual Drawdown Data for Recovery Test
Well 37367

Pumping Well: 37367
Observation Well: 37367
Recovery Test
04/14/88 15:43

Elapsed Time (min)	Drawdown Value (ft)
0.0000	12.10
0.0033	12.12
0.0066	11.68
0.0099	11.66
0.0133	11.45
0.0166	11.21
0.0200	10.97
0.0233	10.76
0.0266	10.55
0.0300	10.35
0.0333	10.13
0.0500	9.12
0.0666	8.26
0.0833	7.58
0.1000	7.00
0.1166	6.45
0.1333	6.03
0.1500	5.63
0.1666	5.29
0.1833	5.00
0.2000	4.75
0.2166	4.51
0.2333	4.27
0.2500	4.05
0.2666	3.83
0.2833	3.60
0.3000	3.39
0.3166	3.20
0.3333	3.05
0.4167	2.47
0.5000	2.01
0.5833	1.70
0.6667	1.47
0.7500	1.31
0.8333	1.18
0.9167	1.08
1.0000	0.99
1.0833	0.92
1.1667	0.86
1.2500	0.80
1.3333	0.75
1.4166	0.72
1.5000	0.69
1.5833	0.66
1.6667	0.64
1.7500	0.62
1.8333	0.61

Table 8. (continued)

1.9167	0.59
2.0000	0.58
2.5000	0.54
3.0000	0.50
3.5000	0.48
4.0000	0.47
4.5000	0.45
5.0000	0.45
5.5000	0.43
6.0000	0.43
6.5000	0.42
7.0000	0.42
7.5000	0.41
8.0000	0.40
8.5000	0.39
9.0000	0.38
9.5000	0.38
10.0000	0.37
12.0000	0.35
14.0000	0.33
16.0000	0.32
18.0000	0.31
20.0000	0.30
22.0000	0.29
24.0000	0.28
26.0000	0.27
28.0000	0.27
30.0000	0.26
32.0000	0.25
34.0000	0.25
36.0000	0.24
38.0000	0.24
40.0000	0.23
42.0000	0.23
44.0000	0.23
46.0000	0.22
48.0000	0.22
50.0000	0.21
52.0000	0.21
54.0000	0.21
56.0000	0.20
58.0000	0.20
60.0000	0.20
62.0000	0.20
64.0000	0.20
66.0000	0.19
68.0000	0.19
70.0000	0.09
72.0000	0.18
74.0000	0.18
76.0000	0.18
78.0000	0.18
80.0000	0.18
82.0000	0.18
84.0000	0.17
86.0000	0.17

Table 8. (continued)

88.0000	0.17
90.0000	0.17
92.0000	0.16
94.0000	0.16
96.0000	0.16
98.0000	0.16
100.0000	0.16
110.0000	0.15
120.0000	0.14
130.0000	0.13
140.0000	0.13
150.0000	0.12
160.0000	0.12
170.0000	0.11
180.0000	0.10
190.0000	0.10
200.0000	0.09
210.0000	0.09
220.0000	0.09
230.0000	0.08

Table 9.
Residual Drawdown Data for Recovery Test
Well 37400

Pumping Well: 37367
Observation Well: 37400
Recovery Test
04/14 15:36

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.58
0.0033	0.58
0.0066	0.58
0.0099	0.58
0.0133	0.58
0.0166	0.58
0.0200	0.58
0.0233	0.58
0.0266	0.58
0.0300	0.58
0.0333	0.58
0.0500	0.58
0.0666	0.58
0.0833	0.58
0.1000	0.57
0.1166	0.57
0.1333	0.57
0.1500	0.57
0.1666	0.56
0.1833	0.56
0.2000	0.56
0.2166	0.55
0.2333	0.55
0.2500	0.55
0.2666	0.55
0.2833	0.54
0.3000	0.54
0.3166	0.54
0.3333	0.54
0.4167	0.53
0.5000	0.52
0.5833	0.51
0.6667	0.50
0.7500	0.50
0.8333	0.49
0.9167	0.49
1.0000	0.49
1.0833	0.48
1.1667	0.47
1.2500	0.47
1.3333	0.47
1.4166	0.47
1.5000	0.46
1.5833	0.46
1.6667	0.46
1.7500	0.46
1.8333	0.45

Table 9. (continued)

1.9167	0.45
2.0000	0.45
2.5000	0.44
3.0000	0.42
3.5000	0.42
4.0000	0.41
4.5000	0.40
5.0000	0.40
5.5000	0.39
6.0000	0.39
6.5000	0.39
7.0000	0.38
7.5000	0.38
8.0000	0.37
8.5000	0.36
9.0000	0.36
9.5000	0.36
10.0000	0.35
12.0000	0.34
14.0000	0.32
16.0000	0.32
18.0000	0.31
20.0000	0.30
22.0000	0.30
24.0000	0.29
26.0000	0.28
28.0000	0.28
30.0000	0.28
32.0000	0.27
34.0000	0.27
36.0000	0.27
38.0000	0.27
40.0000	0.26
42.0000	0.26
44.0000	0.26
46.0000	0.26
48.0000	0.26
50.0000	0.26
52.0000	0.26
54.0000	0.25
56.0000	0.25
58.0000	0.25
60.0000	0.25
62.0000	0.25
64.0000	0.25
66.0000	0.24
68.0000	0.24
70.0000	0.24
72.0000	0.24
74.0000	0.24
76.0000	0.24
78.0000	0.24
80.0000	0.24
82.0000	0.23
84.0000	0.23
86.0000	0.23

Table 9. (continued)

88.0000	0.23
90.0000	0.23
92.0000	0.23
94.0000	0.23
96.0000	0.23
98.0000	0.22
100.0000	0.23
110.0000	0.22
120.0000	0.21
130.0000	0.20
140.0000	0.19
150.0000	0.19
160.0000	0.18
170.0000	0.17
180.0000	0.17
190.0000	0.16
200.0000	0.16
210.0000	0.15
220.0000	0.15
230.0000	0.14

Table 10.
Residual Drawdown Data for Recovery Test
Well 37401

Pumping Well: 37367
Observation Well: 37401
Recovery Test
04/14/88 15:43

Elapsed Time (min)	Drawdown Value (ft)
0.0000	0.36
0.0033	0.36
0.0066	0.36
0.0099	0.36
0.0133	0.36
0.0166	0.36
0.0200	0.36
0.0233	0.36
0.0266	0.36
0.0300	0.36
0.0333	0.36
0.0500	0.36
0.0666	0.36
0.0833	0.36
0.1000	0.36
0.1166	0.36
0.1333	0.36
0.1500	0.36
0.1666	0.36
0.1833	0.36
0.2000	0.36
0.2166	0.36
0.2333	0.36
0.2500	0.36
0.2666	0.36
0.2833	0.36
0.3000	0.36
0.3166	0.36
0.3333	0.36
0.4167	0.36
0.5000	0.36
0.5833	0.36
0.6667	0.36
0.7500	0.36
0.8333	0.36
0.9167	0.36
1.0000	0.35
1.0833	0.35
1.1667	0.35
1.2500	0.35
1.3333	0.34
1.4166	0.34
1.5000	0.34
1.5833	0.33
1.6667	0.33
1.7500	0.33
1.8333	0.32

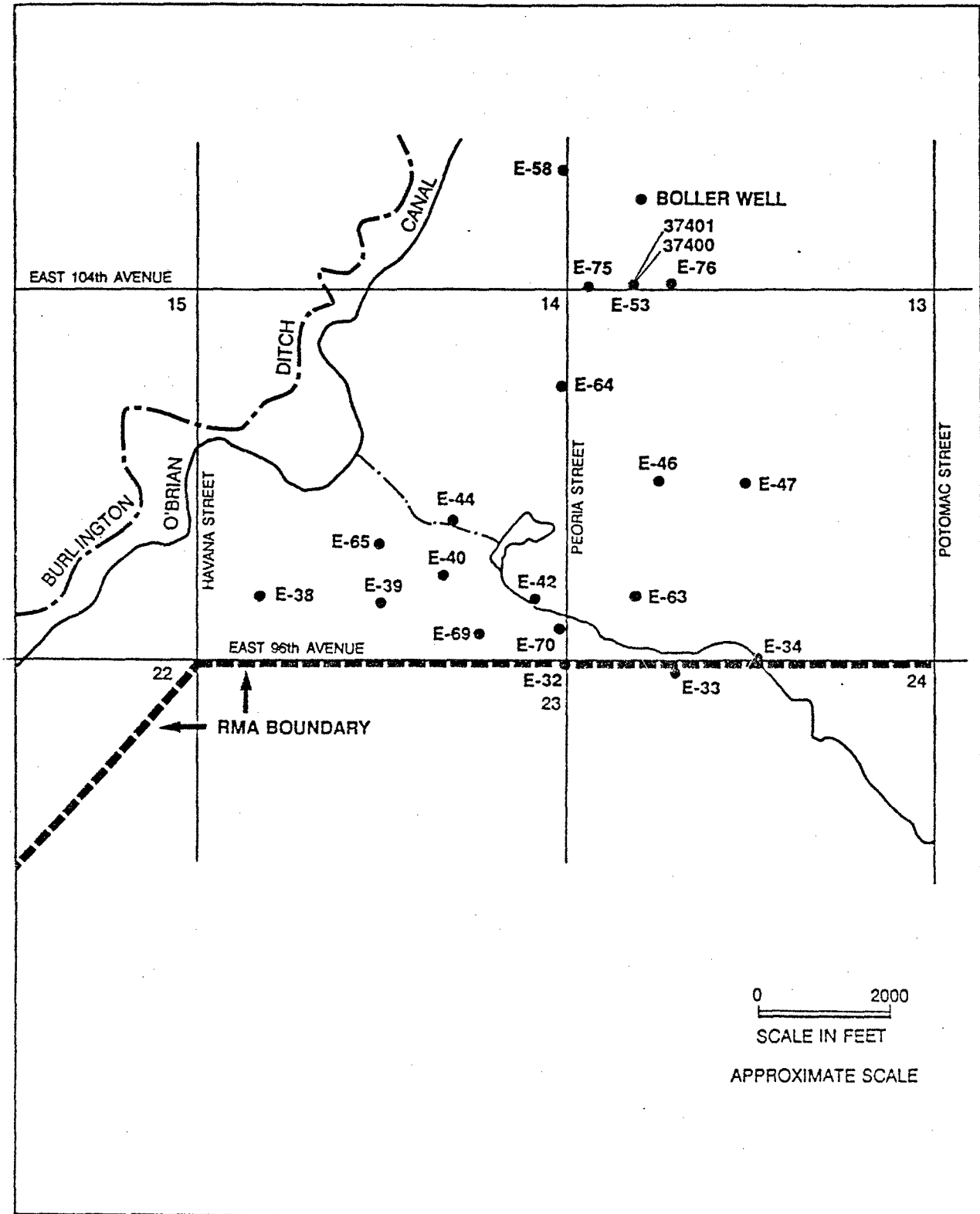
Table 10. (continued)

1.9167	0.32
2.0000	0.32
2.5000	0.32
3.0000	0.31
3.5000	0.30
4.0000	0.30
4.5000	0.30
5.0000	0.30
5.5000	0.30
6.0000	0.30
6.5000	0.30
7.0000	0.30
7.5000	0.30
8.0000	0.30
8.5000	0.29
9.0000	0.28
9.5000	0.28
10.0000	0.28
12.0000	0.26
14.0000	0.23
16.0000	0.22
18.0000	0.22
20.0000	0.22
22.0000	0.21
24.0000	0.21
26.0000	0.19
28.0000	0.19
30.0000	0.19
32.0000	0.19
34.0000	0.20
36.0000	0.19
38.0000	0.19
40.0000	0.19
42.0000	0.18
44.0000	0.18
46.0000	0.18
48.0000	0.18
50.0000	0.18
52.0000	0.18
54.0000	0.17
56.0000	0.17
58.0000	0.17
60.0000	0.17
62.0000	0.16
64.0000	0.16
66.0000	0.16
68.0000	0.15
70.0000	0.15
72.0000	0.15
74.0000	0.14
76.0000	0.14
78.0000	0.14
80.0000	0.14
82.0000	0.14
84.0000	0.13
86.0000	0.13

Table 10. (continued)

88.0000	0.13
90.0000	0.13
92.0000	0.13
94.0000	0.12
96.0000	0.12
98.0000	0.12
100.0000	0.12
110.0000	0.10
120.0000	0.09
130.0000	0.08
140.0000	0.07
150.0000	0.06
160.0000	0.06
170.0000	0.04
180.0000	0.03
190.0000	0.02
200.0000	0.02
210.0000	0.01
220.0000	0.02
230.0000	0.01

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Well Location Map
Rocky Mountain Arsenal
Adams County, Colorado

PLATE

1

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17053.103.10

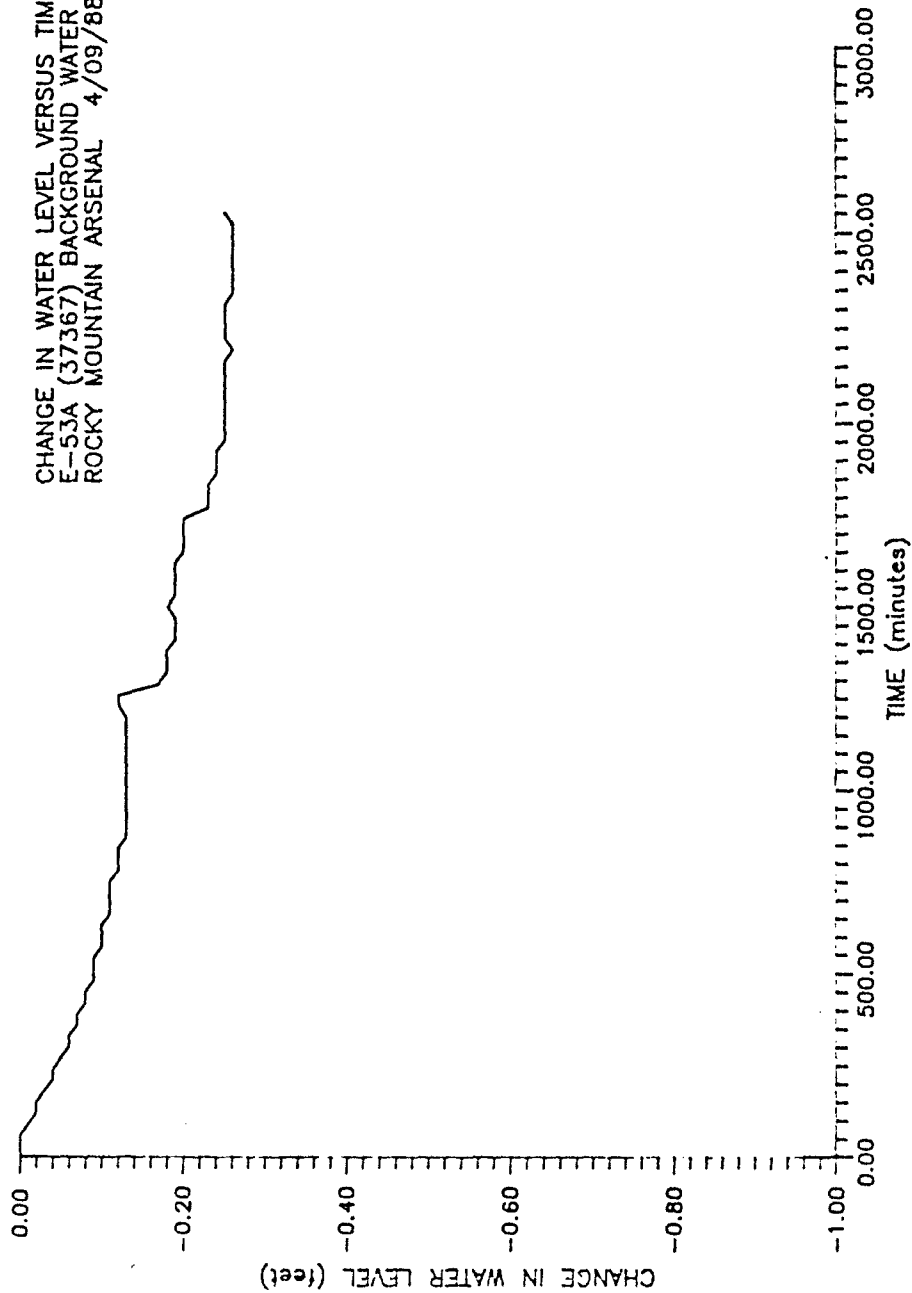
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DATE
6/88

REVISED

DATE

CHANGE IN WATER LEVEL VERSUS TIME
E-53A (37367) BACKGROUND WATER LEVELS
ROCKY MOUNTAIN ARSENAL 4/09/88

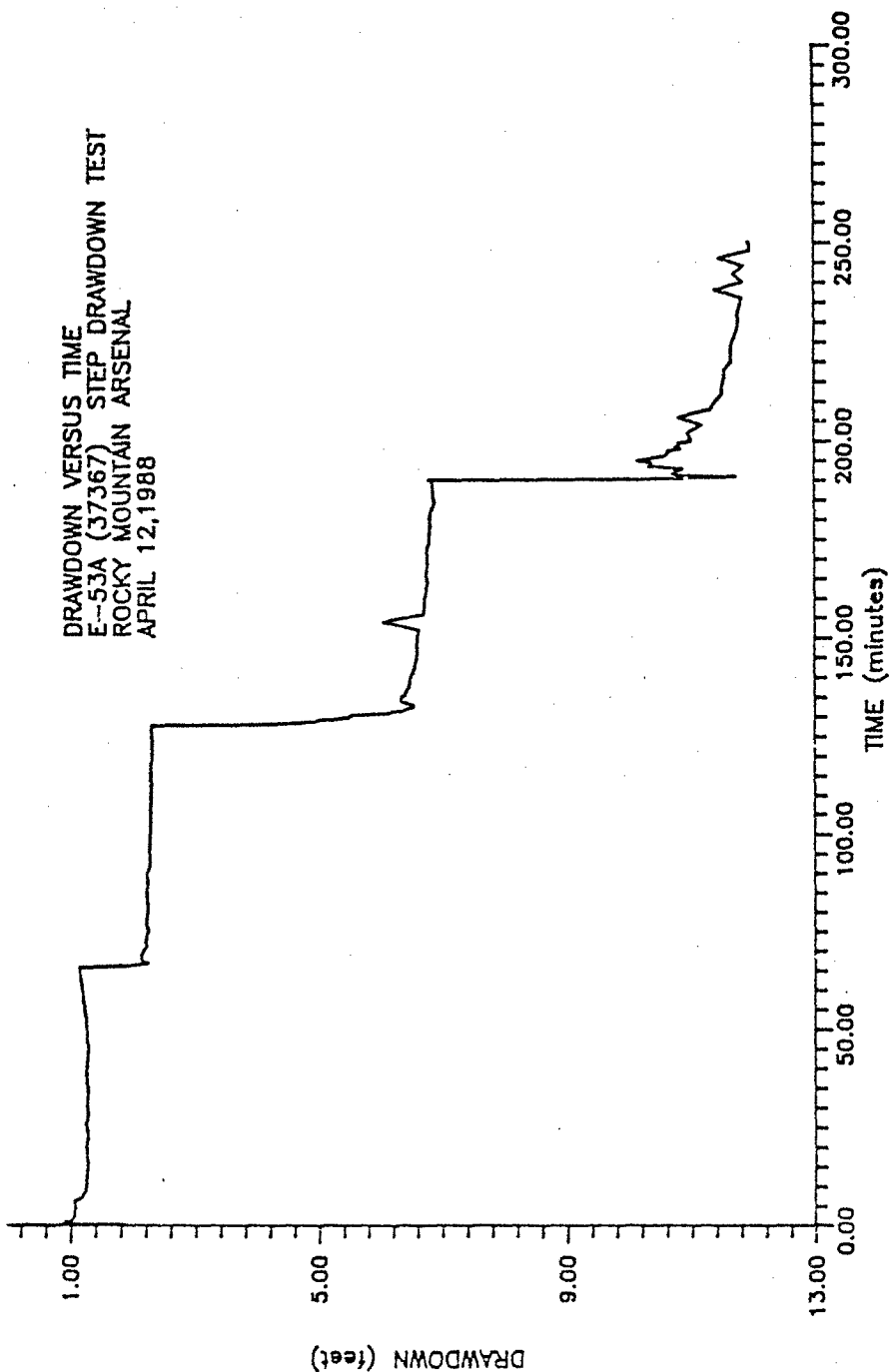


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Change in Water Level Versus Time for Well 37367
Rocky Mountain Arsenal
Adams County, Colorado

PLATE

2



Harding Lawson Associates
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Drawdown Versus Time for Well 37367
Step-Drawdown Test
Rocky Mountain Arsenal
Adams County, Colorado

PLATE

3

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JOB NUMBER
17053.103.10

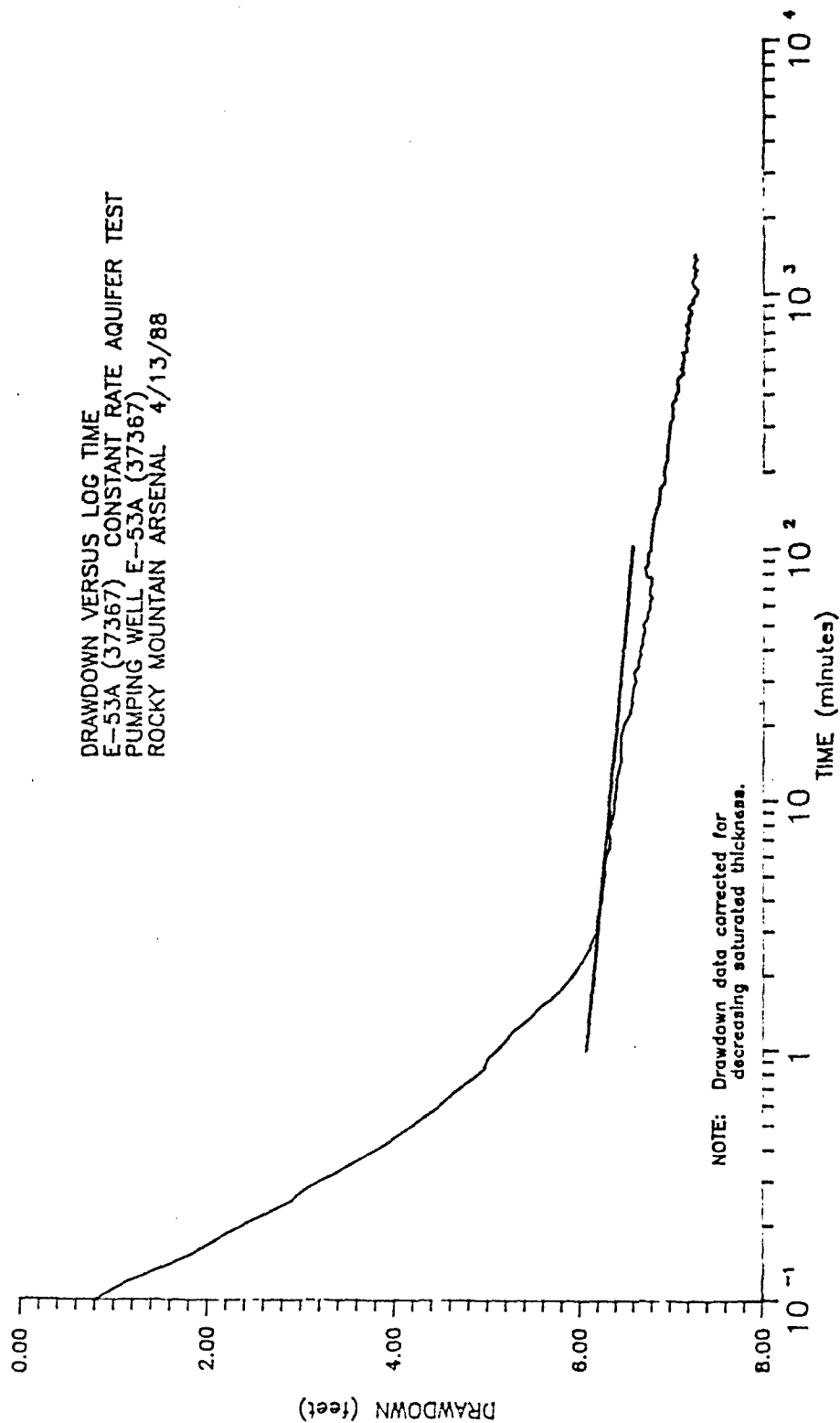
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5/88

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DATE

DRAWDOWN VERSUS LOG TIME
 E-53A (37367) CONSTANT RATE AQUIFER TEST
 PUMPING WELL E-53A (37367)
 ROCKY MOUNTAIN ARSENAL 4/13/88



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Drawdown Versus Log Time for Well 37367
 Rocky Mountain Arsenal
 Adams County, Colorado

PLATE

4

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 17053.103.10

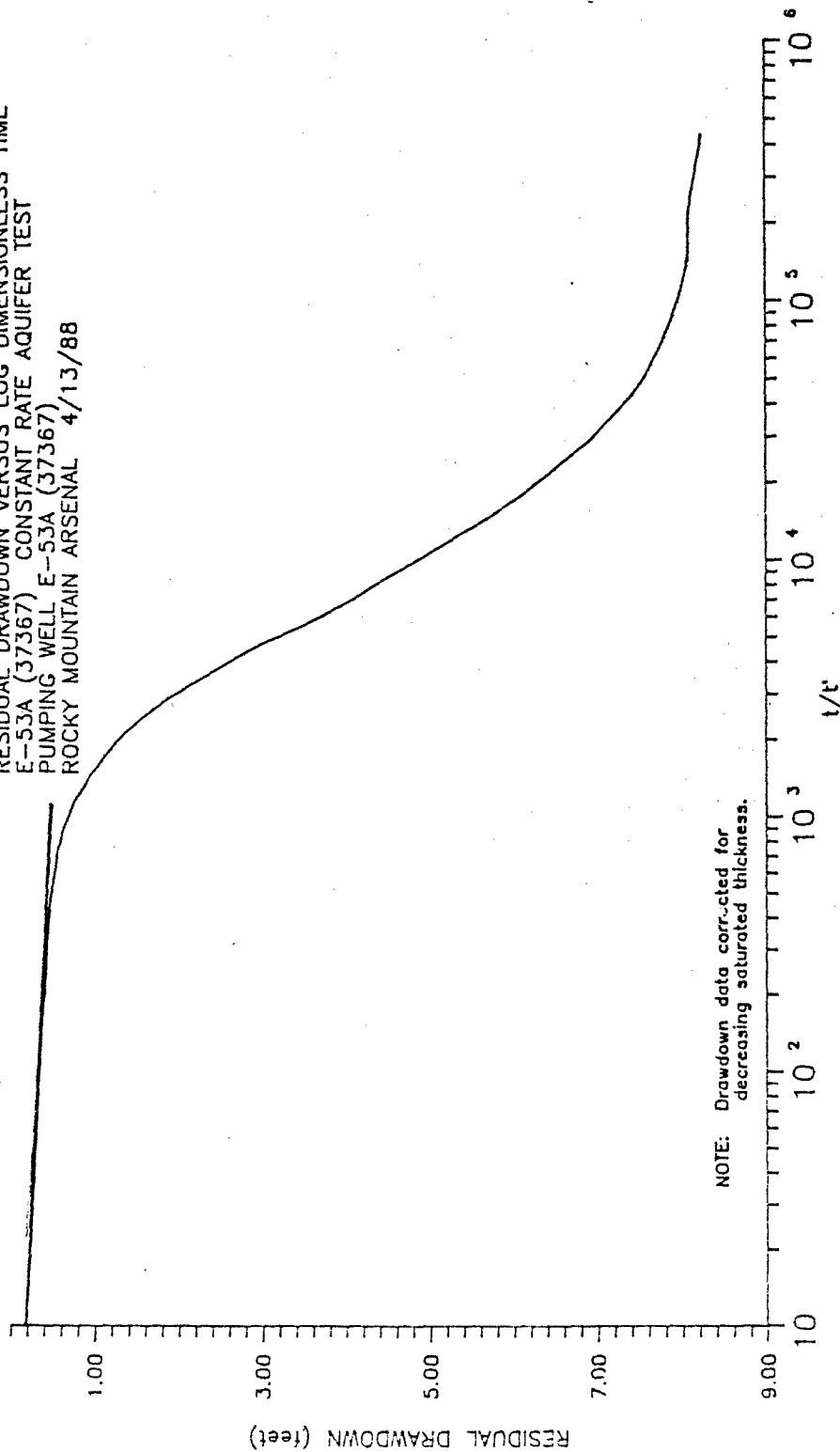
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DATE

RESIDUAL DRAWDOWN VERSUS LOG DIMENSIONLESS TIME
 E-53A (37367) CONSTANT RATE AQUIFER TEST
 PUMPING WELL E-53A (37367)
 ROCKY MOUNTAIN ARSENAL 4/13/88



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**Residual Drawdown Versus Log Dimensionless Time
 for Well 37367**
 Rocky Mountain Arsenal
 Adams County, Colorado

PLATE

5

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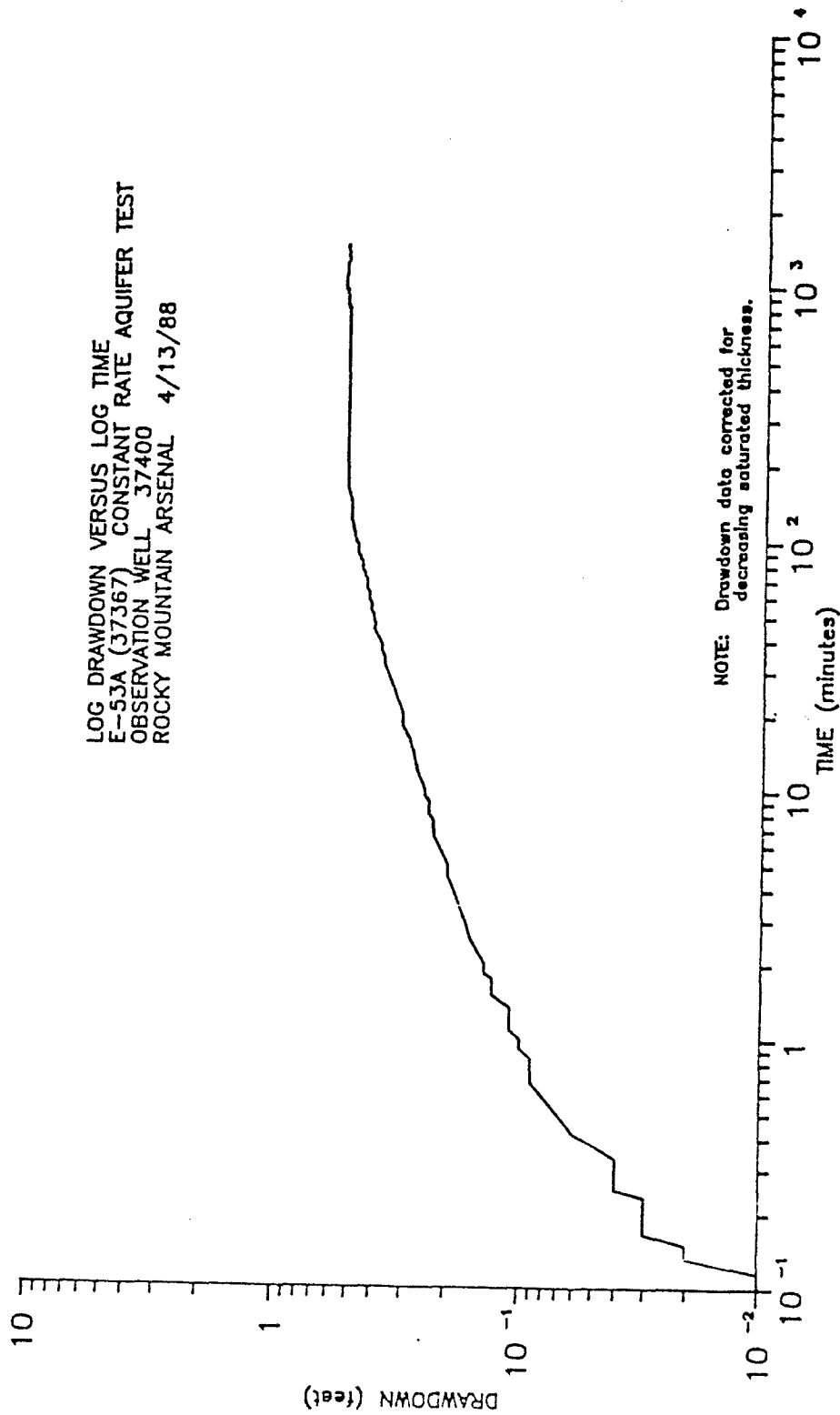
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DATE

4138

LOG DRAWDOWN VERSUS LOG TIME
 E-53A (37367) CONSTANT RATE AQUIFER TEST
 OBSERVATION WELL 37400
 ROCKY MOUNTAIN ARSENAL 4/13/88



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Log Drawdown Versus Log Time for Well 37400
 Rocky Mountain Arsenal
 Adams County, Colorado

PLATE

6

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 17053,103.10

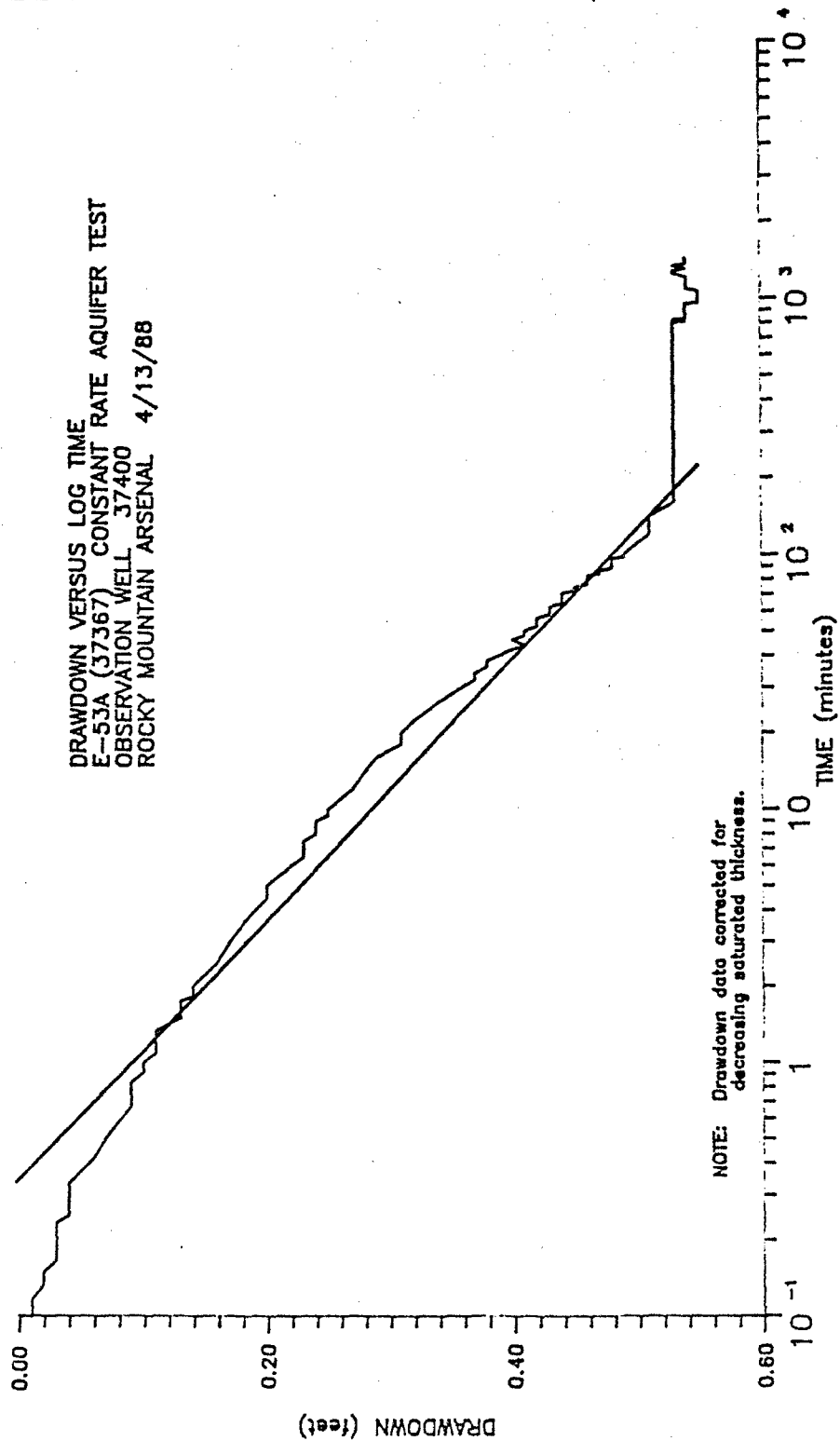
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DATE
 5/88

REVISED

DATE

DRAWDOWN VERSUS LOG TIME
 E-53A (37367) CONSTANT RATE AQUIFER TEST
 OBSERVATION WELL 37400
 ROCKY MOUNTAIN ARSENAL 4/13/88



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Drawdown Versus Log Time for Well 37400
 Rocky Mountain Arsenal
 Adams County, Colorado

PLATE

7

DRAWN
 MOI

JOB NUMBER
 17053.103.10

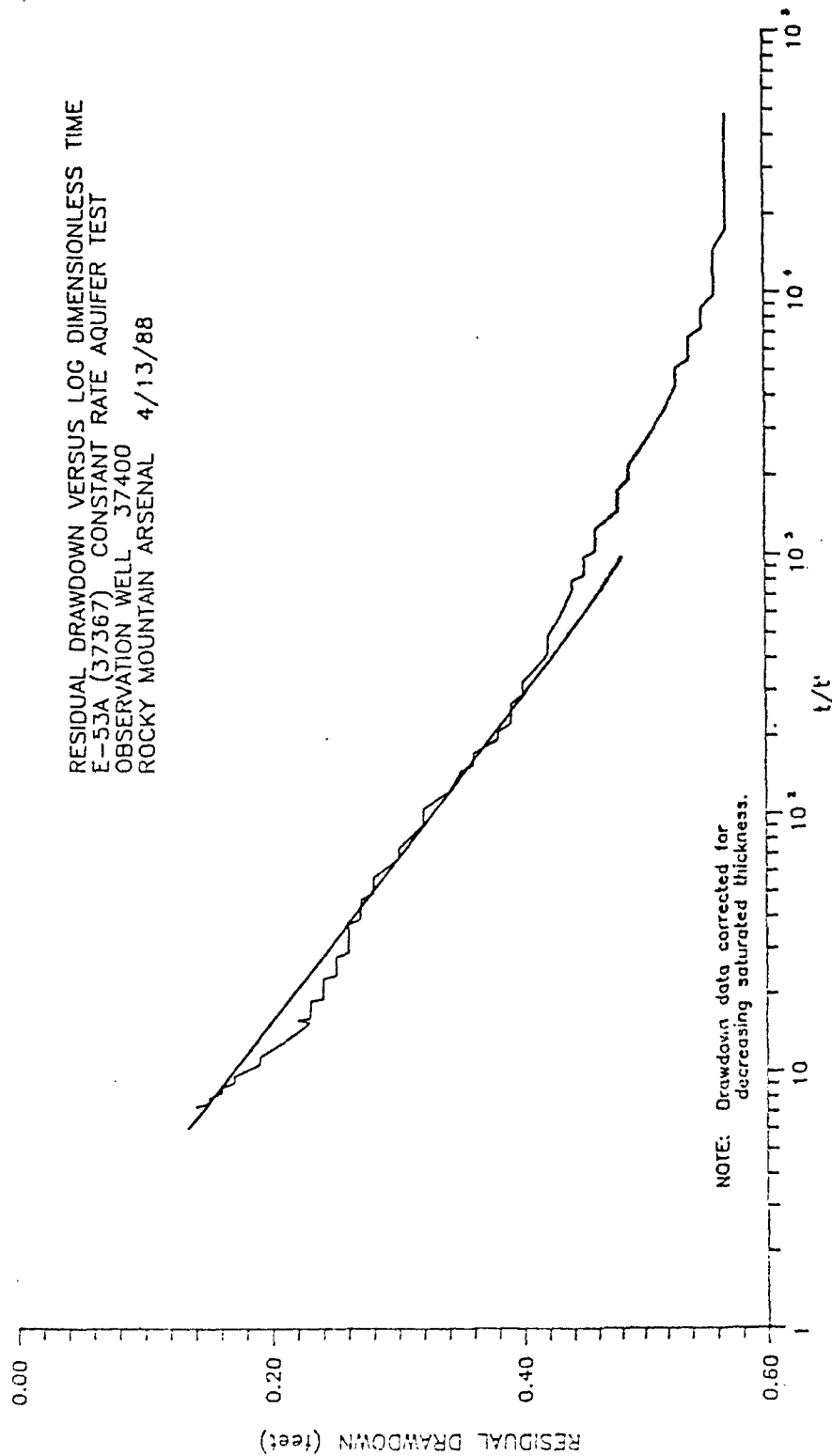
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DATE
 5/88

REVISED

DATE

RESIDUAL DRAWDOWN VERSUS LOG DIMENSIONLESS TIME
 E-53A (37367) CONSTANT RATE AQUIFER TEST
 OBSERVATION WELL 37400
 ROCKY MOUNTAIN ARSENAL 4/13/88



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Residual Drawdown Versus Log Dimensionless Time
 for Well 37400
 Rocky Mountain Arsenal
 Adams County, Colorado

PLATE
 8

DRAWN
 MOI

CR NUMBER
 17053.103.10

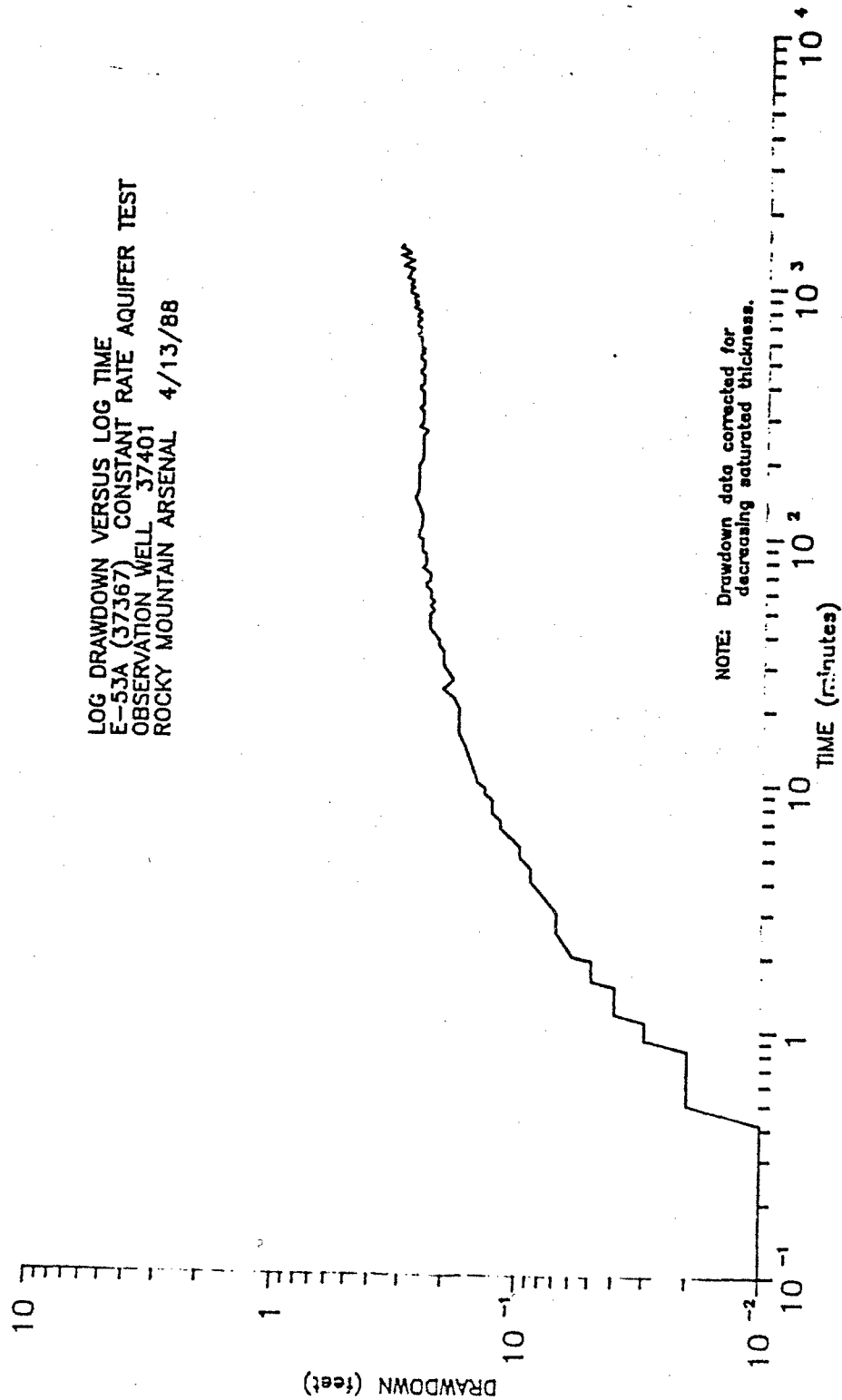
APPROVED

DATE
 5/88

REVISED

DATE

LOG DRAWDOWN VERSUS LOG TIME
 E-53A (37367) CONSTANT RATE AQUIFER TEST
 OBSERVATION WELL 37401
 ROCKY MOUNTAIN ARSENAL 4/13/88



Harding Lawson Associates
 Engineers and Geoscientists

Log Drawdown Versus Log Time for Well 37401
 Rocky Mountain Arsenal
 Adams County, Colorado

PLATE

9

DRAWN
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JOB NUMBER
 17053.103.10

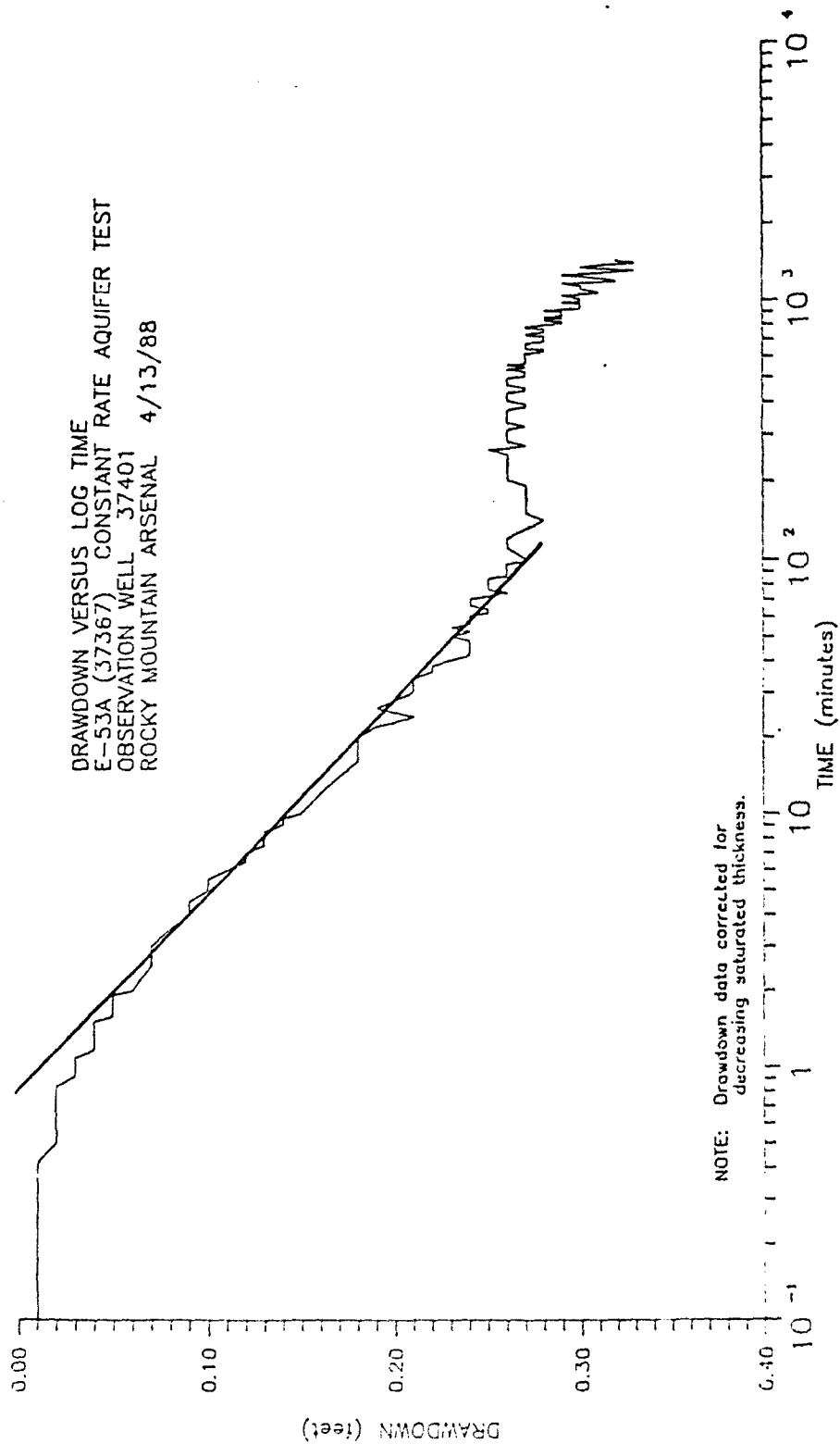
APPROVED
 JMO

DATE
 5/88

REVISED

DATE

DRAWDOWN VERSUS LOG TIME
 E-53A (37367) CONSTANT RATE AQUIFER TEST
 OBSERVATION WELL 37401
 ROCKY MOUNTAIN ARSENAL 4/13/88

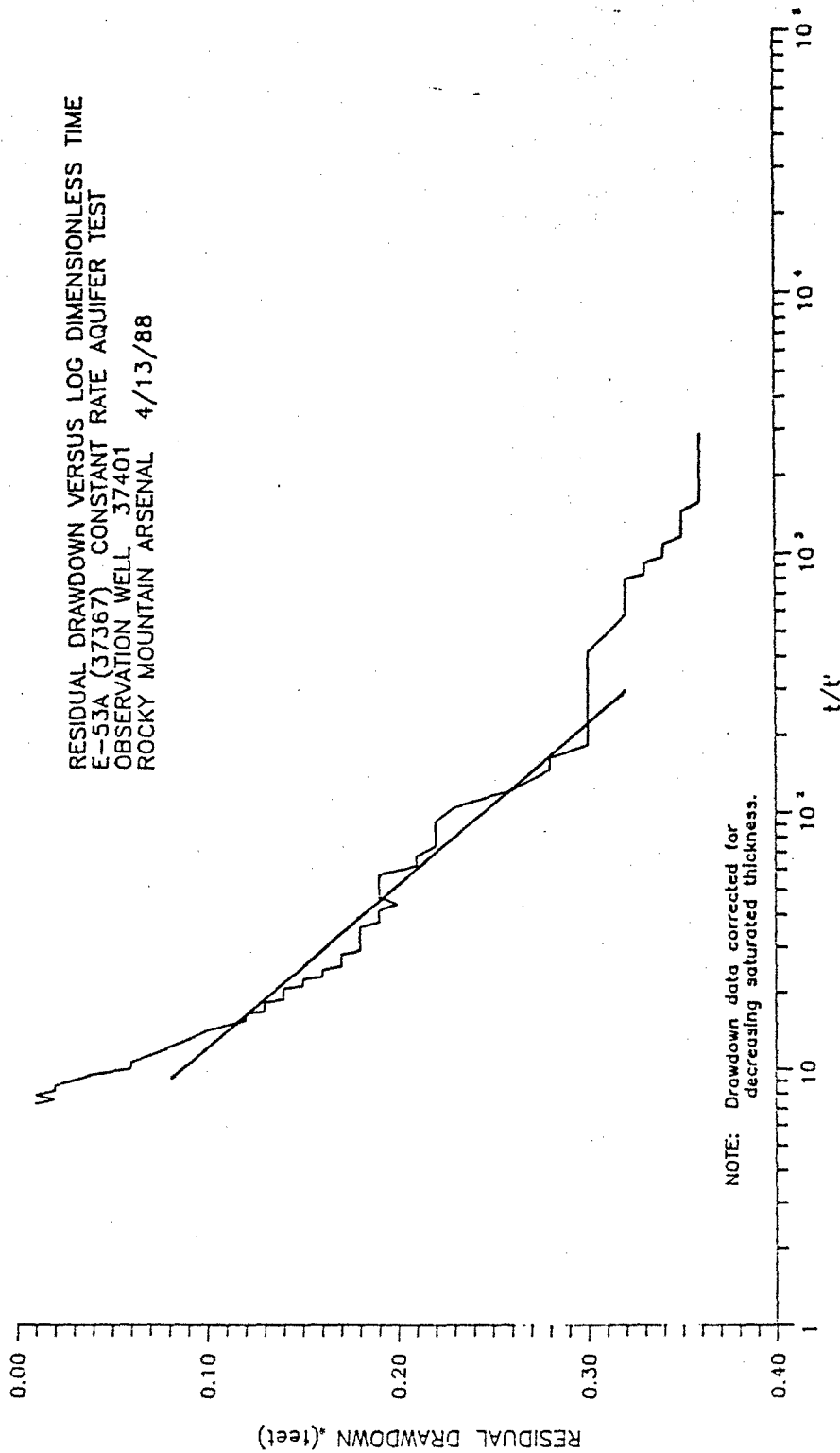


Harding Lawson Associates
 Engineers and Geoscientists

Drawdown Versus Log Time for Well 37401
 Rocky Mountain Arsenal
 Adams County, Colorado

10

RESIDUAL DRAWDOWN VERSUS LOG DIMENSIONLESS TIME
 E-53A (37367) CONSTANT RATE AQUIFER TEST
 OBSERVATION WELL 37401
 ROCKY MOUNTAIN ARSENAL 4/13/88



Harding Lawson Associates
 Engineers and Geoscientists

Residual Drawdown Versus Log Dimensionless Time
for Well 37401
 Rocky Mountain Arsenal
 Adams County, Colorado

PLATE

11

DRAWN
 MOI

JOB NUMBER
 17053.103.10

APPROVED

DATE
 5/88

REVISED

DATE

Sheet 1. Modified Non-Equilibrium Method for Well 37367

Modified Non-Equilibrium Method (Jacob, 1950)

Pumping Well 37367

Observation Well 37367

Reference Plate 4

Q	Constant Pumping Rate	32.3	gpm
Δs	Change in Drawdown per One Log Cycle	0.28	feet
b	Saturated Aquifer Thickness	19	feet

TRANSMISSIVITY (T)

$$T = (264 Q) / \Delta s$$

$$T = 30,000 \text{ gpd/ft}$$

$$T = 4,000 \text{ ft}^2 / \text{day}$$

$$T = 370 \text{ m}^2 / \text{day}$$

HYDRAULIC CONDUCTIVITY (K)

$$K = T / b$$

$$K = 210 \text{ ft/day}$$

$$K = 0.074 \text{ cm/sec}$$

Sheet 2. Residual Drawdown Method for Well 37367

Residual Drawdown Method (Theis, 1935)

Pumping Well 37367
Observation Well 37367
Reference Plate 5

Q	Constant Pumping Rate	32.3	gpm
Δs	Change in Drawdown per One Log Cycle	0.15	feet
b	Saturated Aquifer Thickness	19	feet

TRANSMISSIVITY (T)

T	= (264 Q)/ Δs
T	= 57,000 gpd/ft
T	= 7,600 ft ² /day
T	= 710 m ² /day

HYDRAULIC CONDUCTIVITY (K)

K	= T/b
K	= 400 ft/day
K	= 0.14 cm/sec

Sheet 3. Unconfined Aquifer Type Curve Method for Well 37400

Unconfined Aquifer Type Curve Method (Prickett, 1965)

Pumping Well 37367
Observation Well 37400
Reference Plate 6

Q	Constant Pumping Rate	32.3 gpm
b	Saturated Aquifer Thickness	19 feet
r	Distance to Pumping Well	39.36 feet

Early-time type curve match point:

$$1/u_A = 1.0 \quad u_A = 1.0 \quad W(u_A, r/D) = 1.0 \quad r/D = 0.0$$

$$s \text{ (drawdown)} = 0.068 \text{ ft} \quad t \text{ (time)} = 0.14 \text{ min.} = 1.0 \times 10^{-4} \text{ days}$$

TRANSMISSIVITY (T)

$$T = 114.6 Q W(u_A, r/D) / s$$

$$T = 54,000 \text{ gpd/ft}$$

$$T = 7,200 \text{ ft}^2/\text{day}$$

$$T = 670 \text{ m}^2/\text{day}$$

HYDRAULIC CONDUCTIVITY (K)

$$K = T/b$$

$$K = 380 \text{ ft/day}$$

$$K = 0.13 \text{ cm/sec}$$

STORATIVITY (S)

$$S = u_A T t / 1.87 r^2$$

$$= 1.9 \times 10^{-3} \text{ dimensionless}$$

Sheet 4. Modified Non-Equilibrium Method for Well 37400

Modified Non-Equilibrium Method (Jacob, 1950)

Pumping Well 37367
Observation Well 37400
Reference Plate 7

Q	Constant Pumping Rate	32.3 gpm
Δs	Change in Drawdown per One Log Cycle	0.19 feet
b	Saturated Aquifer Thickness	19 feet
t_0	Time to Zero Drawdown Intercept	0.34 min. 1.2×10^{-4} days
r	Distance to Pumping Well	39.36 feet

TRANSMISSIVITY (T)

$$\begin{aligned}T &= (264 Q) / \Delta s \\T &= 45,000 \text{ gpd/ft} \\T &= 6,000 \text{ ft}^2/\text{day} \\T &= 560 \text{ m}^2/\text{day}\end{aligned}$$

HYDRAULIC CONDUCTIVITY (K)

$$\begin{aligned}K &= T/b \\K &= 320 \text{ ft/day} \\K &= 0.11 \text{ cm/sec}\end{aligned}$$

STORATIVITY (S)

$$\begin{aligned}S &= 0.3 T t_0 / r^2 \\S &= 2.1 \times 10^{-3} \text{ dimensionless}\end{aligned}$$

Time (t) after which $u < 0.01$

$$\begin{aligned}t &= 1.87 r^2 s / u T \\t &= 0.007 \text{ days} \\t &= 10 \text{ min}\end{aligned}$$

Sheet 5. Residual Drawdown Method for Well 37400

Residual Drawdown Method (Theis, 1935)

Pumping Well 37367
Observation Well 37400
Reference Plate 8

Q	Constant Pumping Rate	32.3	gpm
Δs	Change in Drawdown per One Log Cycle	0.16	feet
b	Saturated Aquifer Thickness	19	feet

TRANSMISSIVITY (T)

T	= (264 Q)/ Δs
T	= 53,000 gpd/ft
T	= 7,100 ft ² /day
T	= 660 m ² /day

HYDRAULIC CONDUCTIVITY (K)

K	= T/b
K	= 370 ft/day
K	= 0.13 cm/sec

Sheet 6. Unconfined Aquifer Type Curve Method for Well 37401

Unconfined Aquifer Type Curve Method (Prickett, 1965)

Pumping Well 37367
Observation Well 37401
Reference Plate 9

Q	Constant Pumping Rate	32.3 gpm
b	Saturated Aquifer Thickness	18 feet
r	Distance to Pumping Well	81.33 feet

Early-time type curve match point:

$$1/u_A = 1.0 \quad u_A = 1.0 \quad W(u_A, r/D) = 1.0 \quad r/D = 2.0$$

$$s \text{ (drawdown)} = 0.078 \text{ ft} \quad t \text{ (time)} = 0.7 \text{ min.} = 4.9 \times 10^{-4} \text{ days}$$

$$r/D = 0.2$$

TRANSMISSIVITY (T)

$$T = 114.6 Q W(u_A, r/D) / s$$

$$T = 47,000 \text{ gpd/ft}$$

$$T = 6,300 \text{ ft}^2/\text{day}$$

$$T = 590 \text{ m}^2/\text{day}$$

HYDRAULIC CONDUCTIVITY (K)

$$K = T/b$$

$$K = 350 \text{ ft/day}$$

$$K = 0.12 \text{ cm/sec}$$

STORATIVITY (S)

$$S = u_A T t / 1.87 r^2$$

$$= 1.9 \times 10^{-3} \text{ dimensionless}$$

Sheet 7. Modified Non-Equilibrium Method for Well 37401

Modified Non-Equilibrium Method (Jacob, 1950)

Pumping Well 37367
Observation Well 37401
Reference Plate 10

Q	Constant Pumping Rate	32.3 gpm
Δs	Change in Drawdown per One Log Cycle	0.12 feet
b	Saturated Aquifer Thickness	18 feet
t_0	Time to Zero Drawdown Intercept	0.8 min. 5.6×10^{-4} days
r	Distance to Pumping Well	81.33 feet

TRANSMISSIVITY (T)

$$\begin{aligned}T &= (264 Q) / \Delta s \\T &= 66,000 \text{ gpd/ft} \\T &= 8,800 \text{ ft}^2 / \text{day} \\T &= 820 \text{ m}^2 / \text{day}\end{aligned}$$

HYDRAULIC CONDUCTIVITY (K)

$$\begin{aligned}K &= T/b \\K &= 490 \text{ ft/day} \\K &= 0.17 \text{ cm/sec}\end{aligned}$$

STORATIVITY (S)

$$\begin{aligned}S &= 0.3 T t_0 / r^2 \\S &= 1.7 \times 10^{-3} \text{ dimensionless}\end{aligned}$$

Time (t) after which $u < 0.01$

$$\begin{aligned}t &= 1.87 r^2 s / uT \\t &= 0.032 \text{ day} \\t &= 46.0 \text{ min}\end{aligned}$$

Sheet 8. Residual Drawdown Method for Well 37401

Residual Drawdown Method (Theis, 1935)

Pumping Well 37367
Observation Well 37401
Reference Plate 11

Q	Constant Pumping Rate	32.3	gpm
Δs	Change in Drawdown per One Log Cycle	0.16	feet
b	Saturated Aquifer Thickness	18	feet

TRANSMISSIVITY (T)

T	= (264 Q)/ Δs
T	= 53,000 gpd/ft
T	= 7,100 ft ² /day
T	= 660 m ² /day

HYDRAULIC CONDUCTIVITY (K)

K	= T/b
K	= 390 ft/day
K	= 0.14 cm/sec

APPENDIX A
GEOLOGIC BORING LOGS

ESEENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7352 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112 • 303/741-0839SHEET 1 OF 4Borehole: E-53A

Well Number: _____

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
0						NO RECOVERY
↓						
20.0		88%	53-A	20-21	ML	sandy silt, 30% M-G sand, 10% R 4/4-6 blk. gross den non-plast, med-stiff, saturated alluvium
21.0						
22.0		94%	53-A	22-24		
23.0						
24.0			E 57A	24-25.0'		
25.0						

Drill Site Geologist: W. CrumleyDate: 12/22/86

Borehole: E53A

Well Number: _____

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
25.0		100%	E53A	25- 26.5	SM	SM, silty sand, 20% silt, 11-c. grain sand, 104K 5/4 wash ben, non-plast, loose, saturated alluvium.
26.0						
26.5		100%	E53A	26.5- 28.0		DECREASE SAND SIZE, f. gr.
27.0						
28.0		100%	E53A	28.0- 29.5		
29.0						
29.5		100%	E53A	29.5- 31.5		
30.0						
31.0						
31.5						

Drill Site Geologist: W. GustafsonDate: 10/22/76

Date: _____

Borehole: E53A

Well Number: _____

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG
						Description
31.6		100%	E53A	31 - 32.5	SM	INCREASE grain size to COARSE Increase grain size to coarse
31.5		100%	E53A	32.5 - 33.5		
32.0						
32.5		100%	E53A	32.5 - 33.5		DECREASE grain size to fine-med grain, color change to 10YR 9/4-6 DRK ywsh brn.
32.0						
33.5		80% 1.5'	E53A	33.5 - 35.0		
34.0						
35.0		1.5	E53A	35.0 - 36.5		INCREASE grain size to coarse grain
36.0						
36.5		1.5	E53A	36.5 - 38.0		COARSE sand w/ 10% gravel SP PRG 8/28
38.0						

Drill Site Geologist: W. SpruntDate: 12/20/86

Borehole: E53A Well Number: _____

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
37.0					SM	
38.0		1.5	E53A	38 - 39.5		
39.0						
39.5						

Drill Site Geologist: W. B. K. Date: 12/22/86
Reviewed By: _____ Date: _____

Borehole: E-53Well Number: OB-137406

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
1	0 ↓ 2	2 / 2	1	0 ↓ 2	SM	Silty sand, fine grained, 45% silt, '5 YR 4/4 dark yellow brown, dry, low plastic med stiff
2	2 ↓ 4	2 / 2	2	2 ↓ 4	SC	Clayey sand fine to medium 25% clay 10 YR 4/4 dark yellowish brown, med stiff moist med plas
3	4 ↓ 6	2 / 2	3	4 ↓ 6	SM	Silty sand, fine to medium grained 30% silt 10 YR 5/3 brown, non cohesive, dry
4	6 ↓ 8	2 / 2	4	6 ↓ 8	SC	Clayey sand, fine to medium grain, 30% clay 10 YR 6/4 light yellowish brown, med stiff moist med plastic
5	8 ↓ 10	2 / 2	5	8 ↓ 10		at 9' changes to fine to coarse
6						at 10' very calcareous

Dave West / Installed

Drill Site Geologist:

/ (Signature) / (Typed) Date: 4.13.88

Reviewed By:

/ (Signature)

Date:

4/20/88

Borehole: E-53

Well Number: OB-1 37400

Depth-Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description	
	10	7/2	6	10	SC	Same as above	10
11	12			12	SM	Silty sand fine to medium, 15% silt 10YR 5/6 yellowish brown, slightly moist low plastic med stite	11
12	12		7	12			12
13	14	2/2		14	SC	Clayey sand, fine to medium 25% clay 10YR 5/6 yellowish brown, slightly moist med stite, low plastic, calc. nod's	13
14	14		8	14			14
15	16	2/2		16			15
16	16		9	16		at 16' clay content increases to 35% grain size increases to fine to coarse	16
17	18	2/2		18			17
18	18		10	18		at 18' clay increases to 45%	18
19	20	2/2		20			19
20							20

Don West - Installer

Drill Site Geologist: [Signature] Date: 4-15-88

Reviewed By: [Signature] Date: 4/20/88



ENVIRONMENTAL SCIENCE AND ENGINEERING, INC.
7332 SOUTH ALTON WAY • SUITE H-1
ENGLEWOOD, COLORADO 80112 • 303/741-0639

SHEET 3 OF 4

Borehole: E-53

Well Number: OB-1 37400

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20	20	.5		20	SC	Same as above, saturated at 20'
21	21	1/2	11	1		
22	22			22		
23	23			23		
24	24	0 1/2	12	24		No recovery from 22 to 25-5
25	25	.5		25		
26	26			26	SM	Silty sand, fine to very coarse, 5% gravel 8% 20% silt, 10% R6/4 light yellow brown, saturated, non plastic, med dense
27	27			27		
28	28			28		
29	29	1/1	14	29		
30	30	1/1	15	30		

Drill Site Geologist: [Signature]

Date: 4/13/88

Reviewed By: [Signature]

Date: 4/20/88

Borehole: E-53

Well Number: OB-1 37400

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
	30 ↓ 32	.5 / 2	16	30 ↓ 32	SM	Same as above
	32 ↓ 34	.5 / 2	17	32 ↓ 34		
	34 ↓ 36	.5 / 2	18	34 ↓ 36		gravel increases to 10% at 36'
	36 ↓ 38	0 / 2	19	36 ↓ 38		no recovery 36' → 38'
	38 ↓ 40				GP	Pearly granitic gravel small to large (2.5") 30% sand fine to very coarse 10YR 5/4 yellowish brown Claystone bedrock mottled, very weathered Silt claystone clasts in silt clay matrix Olive with blue-gray clasts

Drill Site Geologist: [Signature]

Date: 4-15-88

Reviewed By: [Signature]

Date: 4/20/88

Borehole: E-5400-2Well Number: 37401

Depth - feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0					SC	SAND, 40% clay, fine to medium grained sand, 10 YR 4/4, dark yellowish brown, moist, low plastic, med stiff.
1	① 0 - 2.0'	2.0 2.0	1	0 - 2.0'		
2						
3	② 2.0 - 4.0'	1.1 2.0	2		SM	SAND, 25% silt, fine to medium grained sand, 10 YR 6/4, light yellowish brown, med stiff, light moist, v. low plastic
4						
5		9.0				
6						
7	③ 4.0 - 8.0'	5.0 2.0	3			
8						
9	④ 8.0 - 12.0'	2.0 2.0	4		SC	SAND, 20% clay, fine to medium grained sand 10 YR 5/4 yellowish brown, stiff, moist, medium plastic
10						

Drill Site Geologist: Dave WestLogged by HubertDate: 4/15/88Reviewed By: HubertDate: 4.20.88

Borehole: E-S308-Z

Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
11	(5) 8.0' to 12.0'	14/2.0			SC	Sand, 20% clay, fine to medium grained, 10YR 5/4 yellowish brown, stiff, moist, medium plastic
12						No Recovery 12-15'
13		0/2.0				
14						
15	(6) 12.0' - 16.0'	8/2.0			SC	Sand, 40% clay, fine to coarse grained sand, 10YR 7/3 very pale brown, stiff, moist, medium plastic, calc.
16						
17	(7) 16.0' - 20.0'	2.0/2.0				at 16.5' Sand, 25% clay, fine to coarse grained sand, 10YR 5/4 yellowish brown, stiff moist, medium plastic, calc.
18						
19						
20						

Drill Site Geologist: Dave West Assisted by Steve Paul

Date: 4/15/88

Reviewed By: [Signature]

Date: 4/20/88

Borehole: F-53-082 Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
20						No Recovery 20-21
21	20.0' - 24.0'	2.0'			SP	SAND, 3% silt, fine to coarse grained, 10YR 5/4 yellowish brown, loose, saturated, non plastic
22					SM	SAND, 10% silt, fine to medium grained sand 10YR 5/4 yellowish brown, loose, saturated, non plastic
23	20.0' - 24.0'	2.0'			SC	SAND, 20% clay, fine to v. coarse sand, occ. small gravel, 10YR 6/4 light yellowish brown, med dense, v. moist, low plastic
24						No Recovery 24-26'
25						
26	24.0' - 28.0'	2.0'			SP	SAND, 3% silt, fine to very coarse grained, 5% small gravels, 10YR 6/4, light yellowish brown, med dense, saturated, non plastic
27	24.0' - 28.0'	2.0'				
28						No Recovery 28-33.5'
29	28.0' - 32.0'	2.0'				
30						

Drill Site Geologist: Dave West Logged by Steve Paul Date: 1/15/88
Reviewed By: Steve Paul Date: 4.20.88

Borehole: E-53-08-2

Well Number: 37401

Depth - Feet	Tube Number Tube Interval	Recovery	Sample Number	Sample Interval	Unified Soil Classification	SOILS LOG Description
0						No Recovery 28-33.5'
1						
2						
3	28.0' - 32.0'	0/2.0				
34	32.0' - 34.0'	0.4/2.0			GC	Gravel, 5% Clay, small to medium (1") gravel, 10% S&S, brown dense, saturated
5	34.0' - 36.0'	1/2.0			SP	Sand, 5% silt, fine to very coarse grained sand, 5% gravel, small to medium gravel (2"), 10% S&S, brown dense, saturated
6						
7						
8						
9						
10	36.0' - 40.0'	0/4.0				
11						
12	40.0' - 42.0'	1.1/2.0				Claystone bedrock, 5% S&S clay, weathered Fe stains
2						TOTAL DEPTH 42'

Well Site Geologist: Dave West Logged by Steve Brown Date: 4/15/88

Reviewed By: [Signature] Date: 4-20-88